CLEANLINESS AND HEALTH

TURNER - COLLINS

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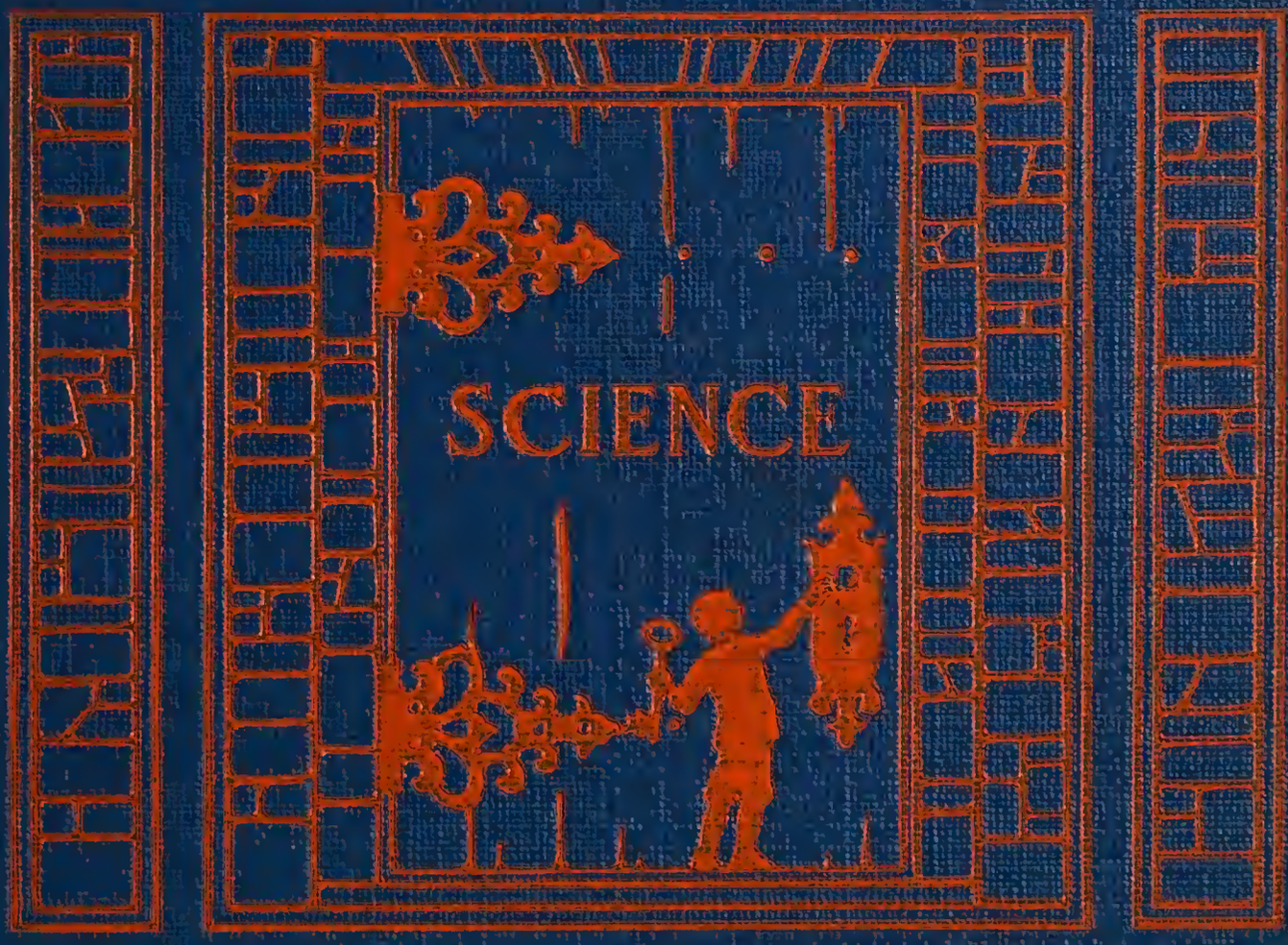

MALDEN HEALTH SERIES

CLEANLINESS AND HEALTH

BY

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PREFACE

This book, like the others of the Malden Health Series, is a product of extended experimental studies in Health Education carried on in the elementary and junior high school grades by the Department of Biology and Public Health at the Massachusetts Institute of Technology and the School Department of the City of Malden. The material was tried and revised during successive years, until we felt sure of the psychology of approach as well as the inherent interest and clearness of the subject matter. It has now been further revised in the light of present-day knowledge and upon the basis of the extensive experience of the teachers who have used the book.

The Italian Institute of Hygiene has the following definition as it motto: "Hygiene tends to make growth more perfect, decline less rapid, death more distant, and life stronger and happier." Health education helps the child toward these objectives through the formation of proper attitudes and habits, and by supplying the scientific facts upon which intelligent health practices are based. These facts are drawn from many sciences —chiefly, of course, from physiology and sanitary science.

The books in the Malden Health Series attempt to

present the physiological basis of healthful living in a way that is clear and interesting. They teach physiology and hygiene, not for the sake of the sciences themselves, but in order to promote the health of the child. Details of anatomy and function, which are interesting as scientific facts but which have no bearing upon present experiences, are soon forgotten and draw the interest of the child away from the subject of his own health. It is believed that such details may well be reserved for later courses. Experience indicates that this course of study contains all the physiology desirable for this age level.

In this book the approach to the subject of bacterial cleanliness and its relation to health is the biological one. This approach is interesting and it gives an appreciation of the importance of the subject without exciting undue anxiety. If a child had never been outside a city tenement district, his first introduction to the plants of the open country should be to the flowers, trees, and grasses—not to poison ivy and snake plums. It is only proper that a similar philosophy should be followed in introducing the child to the plants of the microscopic world. Experience has indicated that this approach will allow the subject of bacteria in relation to health to be taught in as much detail as may be desired or as may be necessary without developing worry or depression.

The broad perspective, sound judgment, and continued support of Superintendent F. G. Marshall were

important factors in making possible the development of this program of study. To Mr. Marshall and to the School Board in Malden, we owe the opportunity for experimentation in *methods* throughout the Health Education studies. To them and to the principals and teachers in the schools where we have worked, we desire to express our most sincere thanks and appreciation for loyal coöperation.

We also wish to express appreciation for assistance and suggestions in the preparation of the manuscript to Miss Bernice Andrews of the Cutler School, Somerville, Mass., Miss May Barry of the Lewis School, Boston, Mass., and Miss Sally Lucas Jean, of New York City, Consultant in Health Education and for some time Director of the Health Education Division of the American Child Health Association.

C. E. T.
G. B. C.

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CLEANLINESS AND HEALTH

I

TRAINING FOR HEALTH

When the United States and Spain went to war in 1898, the Cubans were already fighting Spain to secure their independence. General Garcia, the leader of the Cubans, was hidden somewhere among the hills toward the center of the island. It was necessary for the President of the United States to reach him with a message at once. How could it be done?

A man named Rowan was called. He sealed up the message in an oilskin pouch and placed it over his heart. Five nights later he landed from an open boat on the shore of Cuba and disappeared into the jungle. On foot and alone he made his way to the interior. There he found General Garcia and delivered his message.*

How much it means to a country in time of need to find a man who can really "carry the message to Garcia"! How proud a man must be to serve his country in a matter of such importance! How glad

* Read for yourself some day the stirring account of this act as told by Elbert Hubbard in "A Message to Garcia."

he must be to possess in himself the qualities that fit him for such service! The desire to serve his country is not enough. He must have the courage to face danger. In addition he must have health, strength, physical fitness, a clear brain, a strong body. He must be able to secure his food and keep it from spoiling. He must protect himself against disease. In short, he must *be* fit and know how to *keep* fit.

Importance of health.—Perhaps none of you will ever be called upon to travel through tropical jungles or perform remarkable deeds in your country's service, but you all wish to do something useful in the world. Not only occasionally in the sorry experiences of war, but more often in the happier times of peace one serves his country and his fellow men.

What do you plan to do when you are grown up? Whatever your work may be, it will demand a strong body, personal attractiveness, and a cheerful disposition. Whether you are to be a doctor, lawyer, or business man, you need to make your body strong and learn how to keep it fit.

It is easy to understand that a man who wants to do active physical work must have health. Did you ever stop to think that the artist, the musician, the teacher, and the business man need health quite as much? Edward Simmons, one of America's greatest painters, writes in his autobiography:

"It is important, perhaps even more for an artist than for any other class of person, to keep himself in trim. . . . It is necessary that he take himself in hand early in life and learn about his own body. . . . In my own case, I was practically an invalid up to the age of thirty, when I made up my mind to overcome my ailments. Artistic effort needs a tremendous amount of vitality back of it to carry it out. . . . Learn your limitations and you can correct them beforehand."

Will you not "take yourself in hand" this year? If

you have "ailments," make up your mind to overcome them. If you have vigorous, abounding health, hold fast to it.

Notice how Mr. Simmons speaks of the importance of taking one's self in hand "early in life." How glad you must be that you have all of life ahead of you, and that you have the wonderful opportunity of beginning *now* to build the sort of body you will need in the years to come!

Fitness for life.—Physical fitness is a magic token which helps to open for you the doors to happiness, success, and joyful service. It adds to all the pleasures of life, and enables you to enter into your work and play with confidence and vigor.

Many health habits are packed full of fun. Who does not enjoy the warm glow of the skin after a cold bath, the joy and exhilaration of an outdoor game, the delight of relaxation after exercise, the pleasure of a cheerful meal? Indeed, this sense of physical well-being adds much to the joy of life.

Sometimes we speak of health as being a gift, but it is not wholly that. *It is what Nature gives you plus what you give yourself.* If you are lucky enough to have been well and strong all your life, you must hold fast to the precious gift that is yours. You can keep it only by earning the right to possess it. If you have been so unfortunate as to have had a poor start in health, you must make up for it by habits of living which will earn for you what Nature failed to give you

in the first place. Indeed, health is to a certain extent within the reach of all. The kind of body you will have five years from now depends very much upon your care of it during that time.

Of course, we do not look upon health for the body as the chief end and aim of life. It is a means to a greater end, which is life itself. We value health because it enriches life.

Many people have given to the world lives that were full of cheerfulness, joy, and usefulness in spite of physical frailty which could not be overcome. Robert Louis Stevenson, although never well from childhood, lived an interesting life, out of which he wrote stories and poems which have given pleasure to children and grown folk.

Do not be discouraged if you are not very well, for you may become one of the world's most useful people in spite of physical weakness. Keep up your attempt to gain health, however, for many people who were thought hopelessly frail in childhood have won their way to vigorous manhood and womanhood. Invest in habits of healthful living and cheerful thinking. You will surely be repaid with high rates of interest!

Training.—You know that men and women reach their highest degree of physical fitness through "training," which simply means regular habits of healthful living. If the athlete needs to go "in training" for his game, and the soldier must undergo constant "drilling" for his service, how much more important it is for the growing boy or girl to go into training for the building of a beautiful, healthy body! Your "body is the temple of your soul." Strive to build it well.

Things You May Like to Do

1. Discuss the habits which are most important for growing boys and girls. Begin with those habits familiarly known as the "Rules of the Game" : *

    1. A full bath oftener than once a week.
    2. Brushing the teeth at least twice every day.
    3. Sleeping long hours with windows open.
    4. Drinking as much milk as possible, but no tea or coffee.
    5. Eating some vegetables every day.
    6. Drinking at least four glasses of water a day.
    7. Playing part of every day outdoors.
    8. A bowel movement every morning.

2. As you study different topics in this book, arrange your list of health-habit rules into groups about common subjects; as, for example, rules about sleep, or rules about exercise, etc.

* Prepared by the American Child Health Association.

II

GROWTH

One way in which you can measure your health is by watching your growth, and the easiest way to do that is to have yourself weighed and measured regularly. Perhaps the boys and girls in your school are already being weighed and measured at regular times. If you have no scale at school now, you may find a way to get one, or you may arrange to weigh yourself at a store. Watching your growth is such good fun that you will not want to miss it.*

Growth.—Do you know how much you have grown during the summer vacation? Compare the gains which have been made in your class. If you have last year's weight records, compute your gains for the whole year. Notice whether you have grown as much as the average boy or girl of your age. If you do not know how much the expected gain is, find it in the tables on page 222.

You will find, of course, that some boys and girls have grown much more than others. There are many reasons for such differences. It is natural for some to be small and for others to grow fast. To a certain extent, children inherit size and figure from their par-

*You will find full directions for weighing and measuring in the appendix of this book.

Measuring for height

ents, and yet many children become larger than either parent.

If you live where there are cold winters, you may find that there is a *seasonal* difference in growth. You are likely to grow faster in the fall and early winter than you do in the spring and early summer. At any time and under any conditions, however, your habits of living have a definite effect upon your rate of growth.

These puppies are brothers—same age—same litter. At weaning time they were the same size. After weaning time both were fed all the cooked cereal and bread they would eat, with some meat added. The big dog was fed milk every day in addition to his other food, while the little dog received no milk.

Indeed, one very important reason why some children grow faster than others is that they have better health habits.

If you live in the country or if you have raised pets, you know that food affects the growth of young animals. They can be made fat or thin by changing their diet. So for the human animal, wholesome foods promote growth, but harmful substances, like alcohol and tobacco, hinder it.

Weighing

Very thin children usually have a shortage of fat and muscle. What can you do to build better muscles? How can you increase that little store of fat which will make you look and feel better? Most of you can increase your rate of growth by following the rules of health faithfully. You need especially to eat plenty of wholesome foods, spend long hours in sleep and rest, and take suitable exercise.

Unusually heavy children need to *grow,* of course, just as other children do, but they want to avoid putting on extra fat. They should not try to *reduce* except under the direction of a doctor or hospital clinic.

Strength.—Another way to watch the development of your body is by testing its strength. You may have had such tests already in your physical training classes. If you have no special teacher for games and exercise, you may wish to secure the directions for using the National Physical Achievement Standards.* These are simple tests in running, jumping, throwing, balancing, and special stunts. You can make one record now, and then repeat the tests later to see how much your strength and ability have increased.

It is interesting to keep a record of your lung expansion and to see how it increases with your growth. Use a tape measure or a firm string which can be measured on a yardstick. Take your chest measure, first with all the breath expelled, and then with a full breath taken in. The difference between the two measurements tells you the amount of your lung expansion. Do you know what will help you to develop a good chest?

Freedom from physical defects.—This is another measure of health. A careful inspection of your body shows whether you have any defects. Such an inspection or health examination should be made by a physician. Your teacher or nurse may assist the doctor

* These can be obtained from the National Recreation Association, 315 Fourth Ave., New York City.

with part of the inspection. If you do not have any examination at school, you can go to your own family physician. It is worth while to find out whether you are "in good repair" and ready for a running start in the game of health.

Finding out that you have defective eyesight or decayed teeth is of little value unless you actually set about having your defects corrected. Have you not seen examples of the way health is improved by the correction of physical defects? Some of you have probably had tonsils and adenoids removed. Did you grow faster or feel better afterward? See if the boys and girls in your class can have all their defects corrected before the middle of the year.

Think for a moment what things stand in the way of your own growth and physical fitness. Is there some physical defect which can be corrected? Have you allowed yourself to develop careless habits of living? Try to remove all hindrances, whether they are defects of body or faults of daily living.

Your growth, your ability in physical tests, and your freedom from physical defects are ways in which to measure your health. How do *you* measure up?

Questions for Discussion

1. Why do children of the same age differ in size?
2. What can a child do to improve his rate of growth?
3. What things may hinder a child's growth?
4. In what ways can you measure the growth and development of your body?

5. How can thin boys and girls help themselves to develop more muscle and "fatten up" a bit?
6. What physical defects occur commonly among children, and who should be consulted in having them corrected?

THINGS YOU MAY LIKE TO DO

1. Make individual weight graphs on which you can keep records of your growth this year. You will find directions in the appendix of this book.
2. Start an honor roll for "Teeth." List on your honor roll the names of all pupils who have had all needed dental work completed.
3. On each weighing day, find out how many members of the class have gained in weight. What percentage is this of the whole class? You may be able to compete with another class to see which has the larger percentage of pupils gaining each month.
4. Write on the blackboard the number of pupils who are known to have defective vision. Change this number whenever a pupil gets his defect corrected. Try to secure one hundred per cent corrections.

III

SOME HEALTH RULES AND THE REASONS FOR KEEPING THEM

One of the best plans for carrying on your health work this year is to divide the program into two parts: first, building up your personal health; second, gaining new knowledge in matters of health. Under such a plan you would give some class time every week to the consideration of each part of your program.

Very likely you will want to organize your class for health training. You will find suggestions for this in the appendix at the end of this book.

In this chapter you will find a *brief statement of the reasons for keeping important rules of health.* The topics may be taken up in any order. They may be used as lessons or as a basis for discussion in a Health Club. The subjects here include *Food, Posture, Care of the Feet, Sleep and Rest, Mind and Nervous System, Exercise, Fresh Air and Sunlight, Eyes, Ears,* and *Safety.** Digestion is considered in the chapter on "Workshops of the Body." There is a special chapter on "The Teeth," and there are many chapters dealing with Cleanliness.

* The material in this chapter is planned to be used for reference at such times as you choose to study the various topics.

Foods containing protein

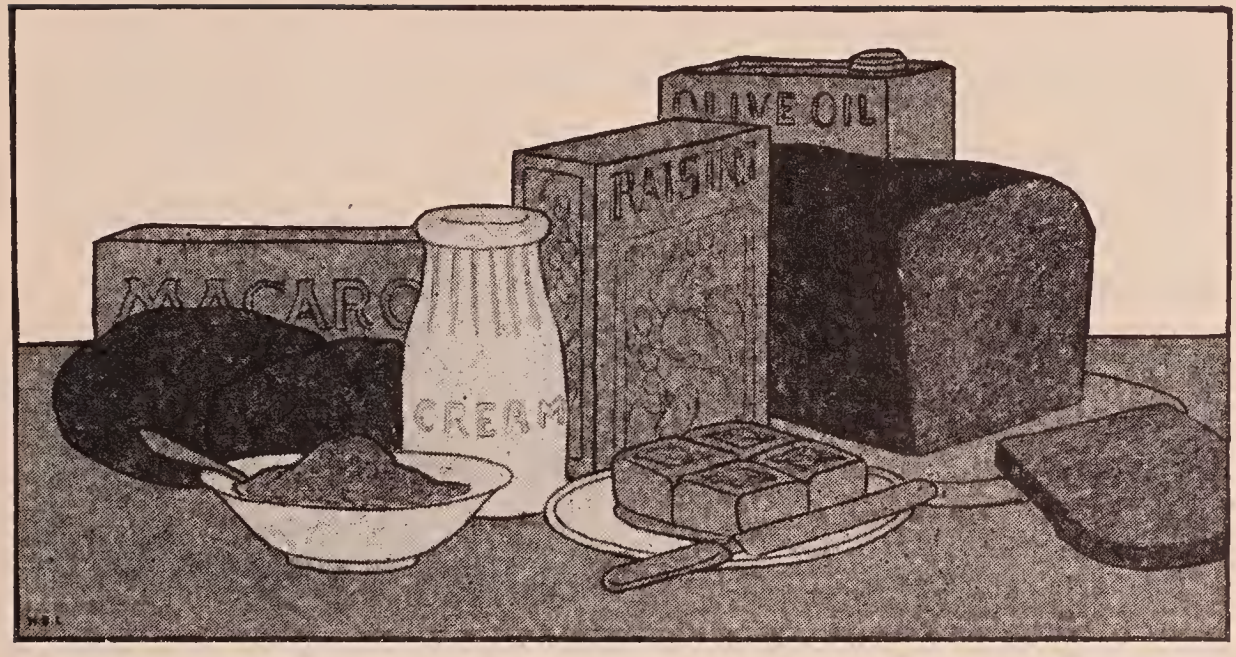
FOOD

Your diet, as you know, is closely related to your health and growth. The various foods supply energy for work and play, as well as building materials for all parts of the body. Boys and girls will make some growth even upon poorly selected foods, but good physical development is dependent upon a diet that supplies all the needed food elements.

The three important groups of food substances are: (1) proteins; (2) carbohydrates; (3) fats.

Proteins.—Proteins are plentiful in such foods as milk, eggs, meat, fish, cheese, peas, and beans. They are used in building and repairing the body; they have some value as fuel.

Carbohydrates.—Carbohydrates are the starches and sugars. Starch is in such foods as potato, bread, macaroni, and cereal. The various kinds of sugar are



Foods containing carbohydrates and fats

found in fruits, milk, and sweet foods. Carbohydrates are used for *fuel* to make the body *go* and keep it warm. They may be changed to fat in the body and stored there as reserve fuel.

Fats.—Fats are in such foods as cream, butter, olive oil, and fat meat. Their use is for fuel, and they, too, may be stored as fat in the body.

Vitamins.—Certain foods contain "magic substances" called *vitamins*. No one knows exactly what they are, but we know where they are found and that they are essential for health and growth. The foods in which vitamins are most abundant are fresh fruits and vegetables (especially the leafy vegetables), eggs, milk, and milk products (cream, butter, cheese), glandular cuts of meat (liver, kidneys, sweetbreads), and whole grains. (One reason why cod liver oil is so good for children is that it is very rich in certain vitamins.)

Grown-ups should eat plenty of these foods for the sake of good health, and for protection from certain diseases which are caused by lack of vitamins in the diet. Children need vitamins for these same reasons, and also for the sake of *growth*.

Minerals.—In addition the body needs iron, calcium, phosphorus, and other mineral substances which must be secured from food. Milk is the chief source of calcium. From two to four glasses a day are recommended for building strong teeth and bones. Iron is found in molasses, in egg yolk, in whole cereals, and in most fruits and vegetables. It is abundant in spinach, carrots, lettuce, celery, prunes, and dates. Enough iron in the diet makes good red blood. Phosphorus abounds in eggs, milk, whole grains, fruits, and vegetables.

Regulator foods.—Coarse foods and water are needed to keep the digestive tract clean. Whole-grain cereals, fruits, vegetables, and dark breads should be a part of the daily diet. Four glasses of water or more between meals daily are needed for internal cleanliness. It is well to start the day by drinking a glass of water before breakfast. (Water is also used in growth; about two-thirds of your whole weight is water.)

Selection of food.—One may eat enough food, so far as quantity is concerned, and yet fail to nourish the body properly. You need certain kinds of food every day:

1. Proteins for building and repair—among the best are milk and eggs. Cheese, meat, and fish are also good protein foods.
2. Carbohydrates for fuel—among the best are cereals, bread, macaroni, spaghetti, and potatoes.
3. Fats for fuel—among the best are cream, butter, and olive oil.
4. Vitamin-containing foods—milk, cream, butter, eggs, fruits, vegetables, whole grains, and glandular cuts of meat.
5. Mineral-containing foods—milk, eggs, fruits, whole grains, and vegetables.
6. Coarse foods—fruits, vegetables, dark breads, whole-grain cereals.
7. Water.

Things You May Like to Do

1. Keep health-habit records showing how much milk you drink every day, what vegetables you eat, etc.
2. Prepare menus, planning meals made up of wholesome foods which can be bought in the market now.
3. See if every one in your class can learn to eat all the different kinds of vegetables.
4. Discuss various ways of cooking eggs. Why are soft-cooked eggs or "dropped" eggs better than fried eggs?
5. Discuss various ways of cooking and serving vegetables.
6. Discuss different kinds of dark, coarse breads.
7. Discuss ways in which fruit can be used in the diet.
8. Discuss ways in which milk and cream can be used.

POSTURE

Sitting.—The points of good sitting posture are as follows: hips well back in chair, feet resting on the floor, chin in, chest high, abdomen flat, back straight (without exaggerated curve either at waistline or shoulders), hands either in the lap or on the desk. The chair and desk should be of the right height so that the feet touch the floor, the knees are not cramped, and the arms rest on the desk without pulling the shoulders out of position.

Standing.—The points of good standing posture are as follows: feet a short distance apart with toes pointing straight ahead, chin in, chest high, abdomen flat, back straight, weight on the balls of the feet, hands relaxed at the sides.

There are several common faults of posture: round shoulders, back hollowed at the waistline, protruding abdomen, forward head, hollow chest. Here are a few simple exercises for correcting these faults.

For round shoulders: Stand in your best posture. Let the arms fall loosely in front of the body, with the shoulders dropped forward. Now, without throwing the rest of the body out of position, lift the shoulders forward and upward, then backward, and let them *drop* in place, with chest high. Repeat several times in front of the mirror and see how this exercise gets your shoulders into position.

Why is one position better than the other?

For back curved at the waistline, or protruding abdomen: Stand against a flat surface of wall, with heels about three inches from the wall and with the body touching the wall from hips to head. Slip your hand between your body and the wall in the curve at the waistline, and see how hard you can push against your hand by pulling with the muscles of your back and abdomen. (Do not hold your breath.) Take your hand out and see if you can pull back so hard that there is not room to slip your hand in at all. When you walk away from the wall, try to hold the same straight position.

For head carried forward: Stand against the wall as in the previous exercise. Pull your chin in as hard as you can, at the same time trying to flatten the back of your neck against the wall. Repeat several times,

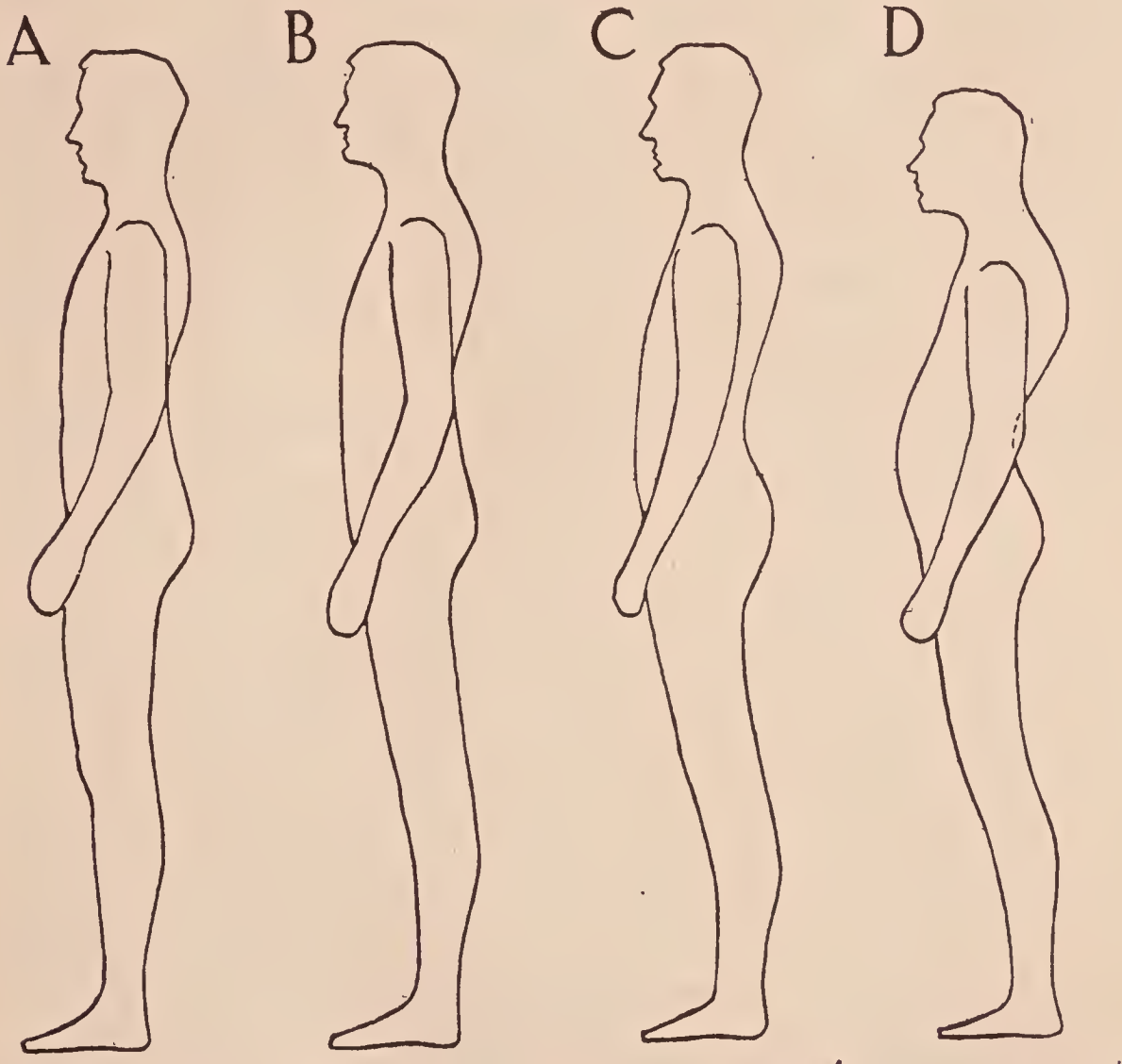
Which is the better position for study?

and try to hold your head straight and tall as you walk away. (Sometimes a person carries his head forward or sideways because his eyesight is defective and he is unconsciously trying to get into a position where he can see better. In such a case, glasses to correct the vision will help to correct the posture.)

For hollow chest: Shoulder exercises, arm stretching, deep breathing, or standing flat against the wall will help to improve the chest. Another corrective measure is to rest in the "hyper-extension" position as follows: Lie on a flat surface with the hands behind the neck and elbows touching the flat surface. Have a *small* pillow placed under your back *just below the shoulders,* so that your chest is raised. Your shoulders drop back, and your abdomen becomes flat. *Be sure that the pillow is placed just below the shoulder blades, not at the waist*

line. Bend the knees so that there is no strain on the abdomen. This position is usually held for ten or fifteen minutes every day.

This chart shows how Harvard freshmen are grouped according to posture.



Group A 7.5 %, Group B 12.5%, Group C 55%, Group D 25%

Daily Habits Related to Posture

1. Sleep at least ten hours every night so that you will feel able to stand and sit well.
2. Play outdoors every day so that you will have muscles strong enough to support your body.

3. Avoid sitting for any length of time in a chair which is too high for you.
4. Take good sitting posture at the beginning of each class period. Avoid twisting the body while writing.
5. Stand well when you recite.

Things You May Like to Do

1. Conduct a campaign to improve daily habits of posture. Let each row act as a team. Let the pupil in the rear seat act as captain. If a pupil stands in poor posture to recite, let the captain call, "Attention!" The teacher will call the captains to attention if necessary. See if you can maintain such good standing posture that calls of "Attention!" are seldom necessary.
2. Find out how good or bad your own posture is. Examine yourself in front of a long mirror at home, and see if you can determine what points you should work to improve. Have inspection of posture at school, and with the help of your teacher, nurse, or physical director discover what faults need to be corrected. Repeat these inspections occasionally to see what improvement has been made.
3. Use corrective exercises to overcome definite faults of posture. If you have a physical director or any person specially trained in the use of exercise, she can advise you individually in regard to correction. You cannot expect to see results from any exercise, however, unless you do it faithfully every day over a period of several months.
4. Study the motion picture "Posture" (Eastman Teaching Films) if it is available. It will show you the proper position and relationship of the different parts of the body and the attractiveness of good posture.

CARE OF THE FEET

The foot is made very much like the hand. There are many small bones over which run strong cords. These bones are held in place by small muscles and ligaments. A long arch, called the longitudinal arch, extends lengthwise of the foot. When this becomes so weak that it drops, it brings about a condition known as flat-foot. A smaller arch, called the transverse arch, extends across the foot just behind the toes. The dropping of this arch may cause calluses on the sole of the foot and pain in the muscles. Arch trouble of any kind requires treatment by a doctor. It can usually be avoided entirely if you use your feet properly and dress them in the right kind of shoes.

These are the requirements for a good shoe. It should be large enough to permit freedom of the foot. The line from heel to toe on the inside of the foot should be straight. The heel should be low and broad, and placed so that its edge is in line with the back of the shoe (not set in under like the French heel). The arch may be either flexible or stiff.

It is not necessary to look "dowdy" because one wears sensible shoes. At present, it is possible to buy a great variety of shoes which have correct lines and are at the same time smart and dressy. Girls sometimes feel that for certain occasions they must have shoes with small heels and narrow toes. If you ever buy a shoe of this sort, be sensible enough to choose one which is not too "extreme," and use it *only* for special occasions.

Footprints of normal feet

Rules for Care of the Feet

1. Walk without scuffing, and with your toes pointing straight ahead.
2. Give your feet exercise through walking, running, and vigorous play.
3. Wear proper shoes for working, standing, and walking.
4. Keep your shoes clean, polished, and in good repair, paying attention especially to run-down heels.
5. Wear stockings which are long enough and shaped to fit the foot.
6. Take off rubbers, or rubber boots, when indoors.
7. Keep your feet clean, and wear clean stockings. Always dry the feet thoroughly after washing.
8. Keep the nails short and clean. Cut them straight across to prevent ingrowing toenails.

Things You May Like to Do

1. Watch yourself to see whether you walk with your feet straight ahead. If you cannot do so, you may need to go to your doctor for special treatment.
2. Examine your own feet to see whether they are healthy and well shaped. Do your toes rest on the floor when you are standing, or do they lift up? (Lifting up of the toes is usually a sign of a weak transverse arch.) Is the line on the inside of your foot straight from heel to toe, without an enlarged big-toe joint? Are

your toes free from corns? Are your feet free from calloused places? When you stamp a print of your wet foot on the floor, is the wet mark for the middle of the foot limited to a line at the outer edge. (It should be, if your longitudinal arch is strong.) Can you lift yourself well up on your toes and keep your balance?

3. Examine your shoes to see whether they have all the requirements of a good shoe.
4. Ask some local dealer to lend you shoe models so that you can have an exhibit of good shoes. Discuss why they are good.
5. When you wear rubbers or rubber boots remove them in the classroom. Watch your little brothers and sisters at home to see that they remove their rubbers in the house.
6. Study the moving picture "The Feet" (Eastman Teaching Films) if it is available.

SLEEP AND REST

The whole body benefits from sleep. The mind and nervous system rest. The muscles relax, and the heart does less work. The body repairs itself and grows. The effect of long hours of sleep shows itself not only in growth but also in posture, personal appearance, disposition, and ability to think and work.

Most grown-ups need at least eight hours of sleep. Some need more. Boys and girls of your age need at least ten. Younger children need eleven or twelve.

A short rest at noon or after school is an excellent thing for children who get tired easily and do not grow as fast as they should. Indeed, many grown-ups make a practice of the mid-day nap. The ability to relax and

Have fresh air while you sleep.

allow one's muscles to become limp is a desirable habit to possess, for it enables one to secure a great deal of rest in a short time.

Rules for Sleep and Rest

1. Have a regular bedtime; do not be late.
2. Make it your usual practice to spend quiet evenings so that you will go to sleep promptly and rest well.

3. Eat a light supper; avoid eating during the evening.
4. Train yourself to relax and go to sleep promptly.
5. Open your windows as wide as you can.
6. Have a clean bed, with light, warm covering and a low pillow, if any. Change sheets and pillow slips each week.
7. Have at least ten hours of sleep every night.
8. Take a rest period regularly every day if you need to.

THINGS YOU MAY LIKE TO DO

1. Check up your habits of sleep by means of health-habit records and health-habit questionnaires. (See the appendix of this book.)
2. Make it fashionable in your class to go to bed early.
3. If you have been averaging less than ten hours of sleep, increase your amount of sleep for the next month and see whether it helps you gain in weight, feel happier, or do better work in school.
4. If you are having a good amount of sleep, but still get tired easily and do not gain well, try a rest period every day and see whether it brings results.

A GOOD MIND AND NERVOUS SYSTEM

The mind is to the body what the captain is to the ship. Without a healthy and well-trained mind the most splendid body cannot bring happiness and success.

You know that it is possible to build a healthy body and to train it. The muscles can be trained to be quick and strong. The ear becomes able to distinguish delicate shades of tone in music. The eye learns to see beauty in harmony of line and color. Do you realize that the mind can be trained, too? You are develop-

ing certain habits of mind as the days go by. Are they habits of cheerfulness or sadness, kindness or selfishness, calmness or worry, happiness or unhappiness?

Effect of the body upon the mind.—Sometimes you find it easy to study; at other times it seems impossible. Sometimes it is perfectly natural to be gay and cheerful, and at other times you feel quite unhappy. Often a condition of the *body* causes the difference in your state of mind. When your bowel habits are not regular, or your digestion is out of order, injurious substances get into the blood and make you feel tired and depressed. Bodily defects, such as diseased tonsils or adenoids, interfere with the work of the mind. Eyestrain, toothache, or any persistent pain affects one's thinking and disposition.

Discuss from your own experience other ways in which habits of living or conditions of the body affect the work of the mind. Improper food, lack of sleep and rest, need of exercise in the fresh air—these and other factors of daily living have a direct relation to mental health.

Certain substances like tea and coffee have an effect upon the mind and nervous system. Boys and girls are naturally very active and they do not need to be "excited" by such substances. The constant use of tea and coffee affects them like the use of a whip on a sensitive horse. It makes them nervous and unsteady. Alcohol and tobacco are much more injurious.

Effect of habits of mind upon the mind itself.—Often a person develops a habit of "nervousness," and makes that an excuse for being constantly cross and irritable. If you allow yourself to become habitually peevish, disagreeable, fault-finding, and selfish, you are not only making yourself extremely unhappy, but you are also making things harder for every one who has to work with you or live with you. The habits you want are those of cheerfulness and good nature. The more often you are grouchy and sulky, the easier such a state of mind becomes. The more you practice cheerfulness, the easier that becomes.

If you feel blue, grouchy, or worried about something, try to force yourself to sing or whistle or smile or look pleasant. Before you realize what has happened, you will really *be* more cheerful and content. Two strong feelings which oppose each other cannot live in the mind at the same time.

The mind can be trained in habits of thinking and concentration too. If you keep your mind on what you are doing, your work will be done quickly. If you let your mind go "day-dreaming," the work will never be done.

Effect of habits of mind upon the body.—Not only do habits of mind affect the mind itself, but they also affect the health of the body. Anger and worry put a stop to the processes of digestion. Indeed, what is called "nervous indigestion" is usually caused by constant mental strain of one kind or another. Such a

condition of the body makes worry still easier, and so the person becomes worse and worse. Worry causes indigestion, and indigestion causes worry.

A person's mind and disposition are reflected in the expression of the face. Intelligence, self-control, honesty, and kindness can all be read in the countenance. Some faces attract you at once, and others repel you. What you like or dislike in a face is chiefly what you see of beauty or ugliness of mind, for thoughts and feelings picture themselves in facial expression.

Boys and girls inherit different traits of mind as they inherit different kinds of bodies. Indeed, your own particular gifts of mind are among the most important factors in making you an interesting person. But regardless of what you inherit, the ability you will have in years to come depends largely upon how you train your mind. Find out what things you can do well and what things you like to do. There are many ways of being successful in life, and every one can find a place for himself.

Rules for a Healthy Mind

1. Build a healthy body, and play the health game.
2. Avoid things which have an injurious effect upon the mind or nervous system—tea, coffee, tobacco, alcohol, drugs.
3. Make it your business to be always cheerful and courteous.
4. Guard especially against habits of temper, sulkiness, and irritability.
5. Form the habit of concentration.

THINGS YOU MAY LIKE TO DO

1. Keep a record for yourself to check the days on which you are able to keep cheerful and pleasant all day, never once allowing yourself to get cross.
2. Decide upon some particular act, either at home or in class, in which your behavior needs improvement. See if you can make such a marked improvement that some one will notice it.

EXERCISE

A great race horse does not acquire his speed by accident. He is trained to the race track from the time he is very young. The athlete grows to his ability slowly, by constant training and practice. In the training of the body for everyday needs, exercise is the means by which muscles are developed to do their work easily and well.

The body as a whole benefits from exercise. There is more rapid breathing and better circulation, so that a greater amount of oxygen is taken from the lungs to all parts of the body. Exercise helps the body to throw off waste more promptly. Food products which are used as fuel are burned more completely in the heat of vigorous exercise. The skin is cleansed by the passage of sweat through the open pores, leaving the waste substances on the outside where they can be washed off.

Exercise improves digestion. The digestive organs are "shaken up," and the muscles of the abdomen which hold them in place are strengthened and invigorated. Daily exercise is one of the best aids to a good digestion,

and it is a health habit which helps to prevent or overcome constipation.

The mind benefits, too, from exercise. It has a rest from study and work. You have probably noticed how play refreshes you when you feel tired from school work.

The lungs are enlarged by exercise, because they are filled more completely with air than in ordinary breathing.

The heart, like other muscles, is strengthened through exercise and made stronger. A heart which is kept strong and healthy will be a health asset in years to come. A child whose heart needs special care should always follow the doctor's directions.

Exercise also helps the body to regulate its temperature. The circulation is kept active and is able to adjust itself more quickly to changed conditions. You know that people who do not exercise regularly are more sensitive to cold than those who do. A good circulation is not only useful in keeping you warm, but it also helps to keep you free from colds.

You can easily see that the benefits of exercise are widespread. Indeed, when you realize the value of exercise, it is difficult to understand how any one can keep really well without it. Fortunately, it is one of the health habits which are very easy for boys and girls to practice. There is a thrill in playing, walking, running, climbing, skating, or swimming which makes the thing a joy in itself. What cheerfulness and contentment of mind follow the hours of vigorous exercise out-

doors! How keen is one's appetite for the coming meal! How quiet and peaceful the long hours of sleep! Exercise outdoors is indeed a health habit which is "packed full of fun."

Rules of Exercise

1. Spend part of every day in play outdoors.
2. Learn to take part in all kinds of sports so that you have opportunity for outdoor exercise at every season of the year.
3. Be a good walker; walking is good exercise; it keeps you in the open and takes you to interesting places.
4. If your posture is poor, do your corrective exercises regularly. Perhaps you all do morning exercises together at your house.

Things You May Like to Do

1. Discuss different sports and games to see which ones offer exercise for nearly all parts of the body.
2. Measure your ability in running, jumping, and other exercises by using the National Physical Achievement Standards.
3. Discuss the relation of other habits to your ability in play and games.
   For example: How does food affect the development of muscles? Does clothing have any relation to outdoor play? How important are disposition and honesty in games?
4. Keep a record showing how much time you spend each day in outdoor play.

FRESH AIR AND SUNLIGHT

We naturally enjoy fresh air and sunlight. Outdoor air usually has more movement and more variation in temperature than the air indoors. The feeling of moving air on the skin is pleasing and stimulating. We feel refreshed when we step from the quiet, warm air

of a room into the fresh, outdoor air. Outdoor play is healthful, not only because of exercise, but also because of the stimulating effect of the moving air on the skin.

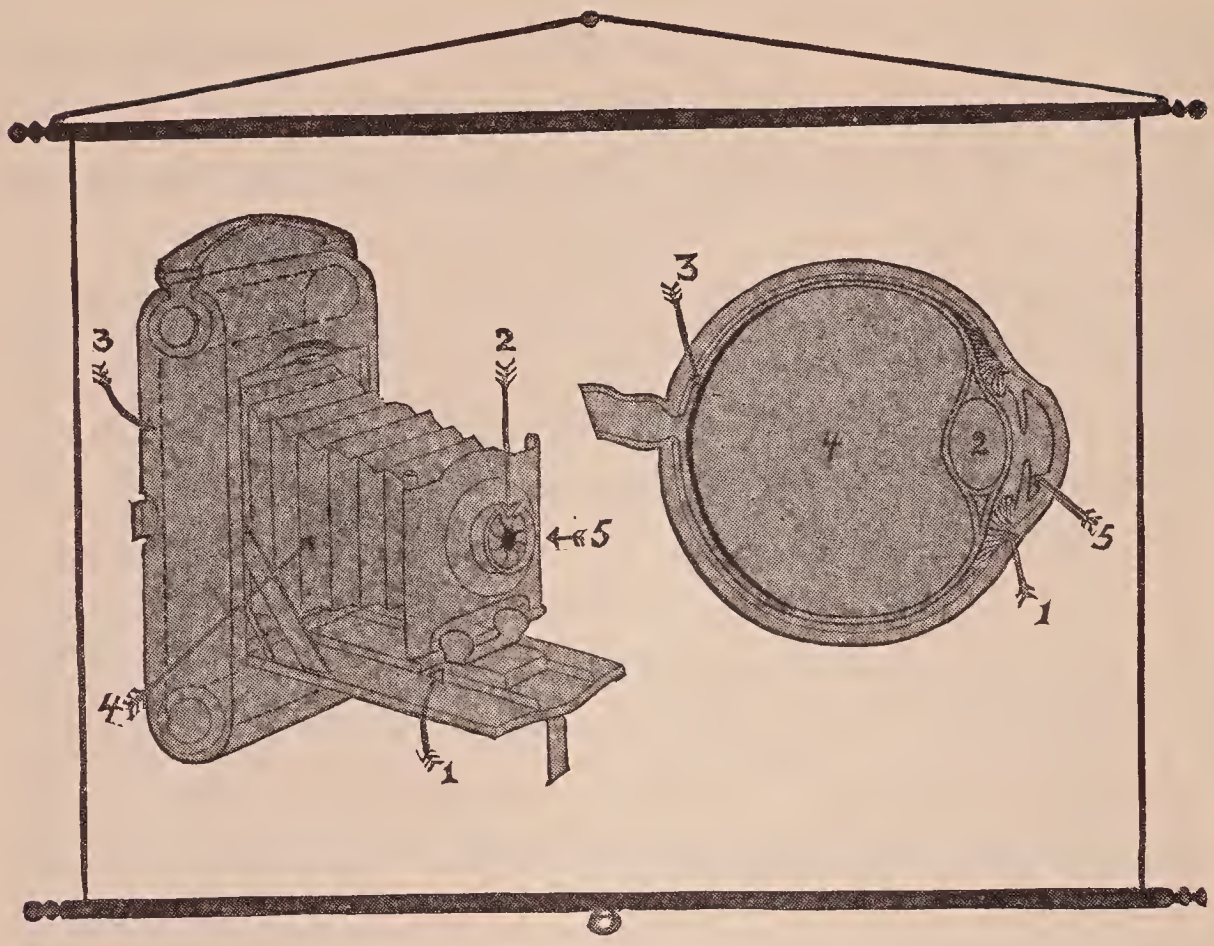
Sunlight plays an important part, too, in the benefits that come from outdoor life. Sunshine is pleasant; it makes us feel cheerful. It also has a real effect upon the growth and development of the body.

Direct sunlight on the skin produces a substance in the body which helps it to use calcium and phosphorus to make good bones and teeth. The same effect is produced by a certain vitamin which is found abundantly in cod liver oil, and in smaller amounts in egg yolk, butter, cream, and whole milk. Babies who have enough sunshine and enough of this vitamin in the diet grow straight and strong. Lack of this vitamin and of sunshine will cause a disease called rickets, in which the bones do not develop properly.

Sunlight is particularly important for babies, but it is also important for older boys and girls. Play outdoors in summer in a bathing suit or a sun suit, if you can, but take care to avoid sunburn. Sunburn injures the skin and, if severe, may make you ill. Expose the body to the sun for a short time at first so that you will develop a tan gradually.

Things You May Like to Do

1. Discuss the reason why fanning makes one feel cooler.
2. Find out how many hours of sunlight there are daily in March, in June, and in December.



The camera and the eye

(1) Focusing device; (2) lens; (3) place where picture is formed; (4) chamber; (5) device for changing size of opening.

EYES

Through the eyes we learn, and by means of them we are able to work and play.

The structure of the eye is like that of a camera. It has a lens which collects the rays of light and makes a picture at the back of the eyeball. The focusing is done by tiny muscles which change the shape of the lens when one is looking at objects near by. The eye is naturally "set" to look at distant objects. It is easy to see why it becomes tired when focused upon near work for long periods of time.

The iris, or colored part of the eye, is like the diaphragm in the camera. It opens or closes to let in more or less light as needed. You can see for yourself that, when facing a bright light, the pupils of the eyes are small—the iris closes to keep out the excessive light which might be injurious. When looking into dim light or darkness, the pupils are large because the iris has dilated to let in all the light possible. Why does flickering light tire the eyes?

Rules for the Care of the Eyes

1. Do not read in dim or flickering light.
2. In doing close work, have the light come from over the shoulder. Bright light shining directly into your face will injure your eyes.
3. Hold work straight, in front of the eyes and about fifteen inches from them.
4. Avoid reading while lying down or on moving cars.
5. Rest the eyes occasionally by closing them or by looking at distant objects. Avoid excess of fine work.
6. Avoid looking at the sun or other brilliant light.
7. Avoid accidents which may injure your own eyes or the eyes of other children.
8. Have foreign particles in the eyes removed carefully by an adult.
9. If you have trouble with your eyes, get the advice of an eye specialist. Wear glasses if you need them. Keep the frames properly adjusted. If the eyes are imperfect, they cannot do good work. You are handicapped if you cannot see as well as other children, and sooner or later your health will suffer from the eyestrain. Tired-looking eyes also detract from personal beauty.

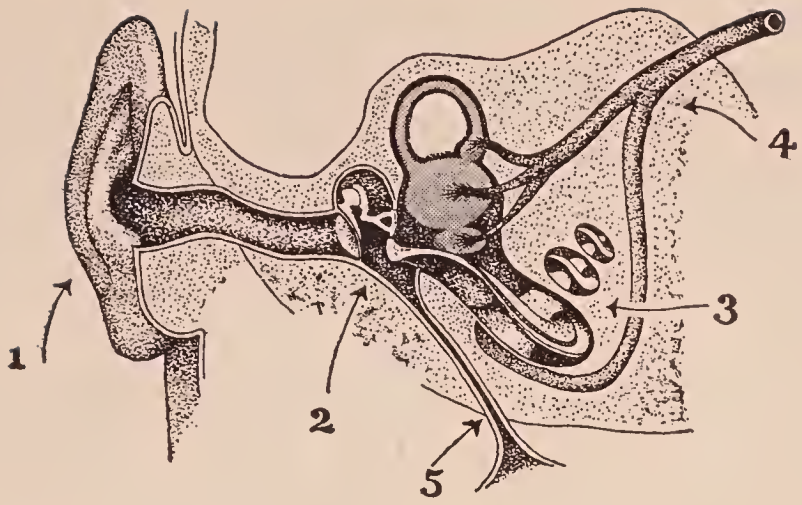
THINGS YOU MAY LIKE TO DO

1. Bring a camera to school and discuss how its various parts are like the parts of the eye.
2. Try this experiment to see how the eye focuses for objects near at hand. Stand near a window which has a screen and look out at the street. While you are looking into the street, you cannot see the screen distinctly. Now if you look directly at the screen, you will find that you cannot see distinctly what is in the street. Your eye cannot focus at the same time on the street, which is distant, and on the screen, which is near.
3. Try this experiment to see how the iris opens and closes in relation to the amount of light. Stand opposite another person who is facing the bright light. Notice how small the pupils of his eyes are. Now have him turn about so that he is facing the darkest part of the room, and see how the pupils dilate.
4. Discuss what to do when bits of dirt get into the eye.

EARS

The sense of hearing adds to our enjoyment of life and usually plays an important part in our ability to do some useful work.

How we hear.—The ear is made up of three parts: the outer ear, the middle ear, and the inner ear. The curved part of the outer ear catches the sound waves as they come through the air, and allows them to pass through the ear canal to the ear drum, which vibrates with the sound waves just as the disk in the mouthpiece of a telephone vibrates when you talk into the telephone. Beyond the drum is the middle ear, which is a hollow



The various parts of the ear and adjoining structures are shown by numbers as follows: (1) outer ear; (2) middle ear; (3) inner ear; (4) nerve; (5) Eustachian tube.

space, filled with air and connected with the upper part of the throat by a passage called the Eustachian tube. Stretching across the middle ear is a chain of three tiny bones, which make the connection from the ear drum to the inner ear. When the drum vibrates with sound waves from the outside, the vibrations are passed along this connecting chain of bones to the inner ear. This is a winding cavity in the bone of the skull, filled with a clear, watery fluid. The fluid takes up the vibrations and passes them on to delicate nerve endings, from which the sensation is carried to the brain.

Taking care of the ears.—When you consider the structure of the ear, and the way in which sound waves are passed on from the ear drum to the inner ear, it is easy to understand the importance of avoiding injury to the drum. The ears should be washed and dried carefully. Never put a sharp instrument into the ear to clean out the wax. Washing the canal with a soft

cloth over the finger will usually keep the ear clean. If wax becomes hardened so that the hearing is affected, it is wise to go to a doctor to have the wax removed.

Sometimes a boy or girl has an ear drum injured by the carelessness of another child in play. Never shout close to a person's ear, "box" his ears, or do any careless thing which may injure another person's hearing for life.

Hearing may be interfered with by injury to the middle ear. The Eustachian tube in children is relatively short, wide, and straight, making it fairly easy for material from the nose or throat to get into the middle ear. Thus bad colds or diseased tonsils or adenoids may lead to disease of the middle ear. Diseased tonsils or adenoids should receive treatment. When you have a cold, blow the nose gently so that fluid may not be forced through the Eustachian tube into the middle ear.

Earache is a sign of trouble, and should receive prompt attention. Never neglect a discharging ear. Go to your doctor, and follow his advice faithfully.

If, because of some accident or illness in childhood, you cannot hear as well as other boys and girls, you should always seek the seat at school where you can hear best, so that you will not hinder yourself needlessly by failing to understand. In some communities, lip reading is taught to children who have poor hearing.

THINGS YOU MAY LIKE TO DO

1. Find out what is being done in your community to help persons who are "hard of hearing."
2. Discuss the way in which the audiometer is used for testing hearing.

SAFETY

No matter how well and strong you are, you may meet with any sort of accident unless you are careful and sensible in your habits of safety. Automobile highways and the busy streets of our modern towns and cities have greatly increased the dangers to which both children and adults are exposed. It is interesting to know that, while the number of accidents for adults has increased constantly in recent years, there has been a steady decrease in the number of accidents to children. Boys and girls are learning to protect themselves against accident by practicing safety. What safety habits do *you* practice to protect yourself and others against needless injury?

RULES FOR SAFETY

A. *In the street*

1. Cross the street only at corners or at traffic crossings.
2. Keep to the right in traffic, and obey the traffic policeman or the light signal when one is present.
3. Always look carefully when crossing the street. Never step into the street backward, or dash carelessly into the street when at play.
4. Cross the street carefully when you get off a street car; never dash around the back of the car to cross the street.

5. Avoid entering the street from between parked cars.
6. Watch out for cars backing out of alleys and driveways.
7. In crossing railroad tracks, look both ways.
8. When riding a bicycle, obey the traffic rules; avoid riding a bicycle on streets with heavy traffic.
9. Do not use roller skates or scooters in the street.
10. Do not "hook" rides on street cars or automobiles.
11. Keep away from fallen wires or cables which may be electrically charged.
12. When hiking on country roads, keep to the left; after dark, wear something white.
13. Set a good example for younger children, and teach them to practice safety.

B. *At school*

1. Obey the safety regulations of your school, both in the building and outside.
2. Know what to do when the fire signal is sounded, and always conduct yourself in an orderly way.
3. Never push another person when there is danger of his falling or being injured. Pushing or crowding at the bubbler fountain often results in broken teeth.
4. Help to keep your playground free from glass, fruit peels, and other dangerous materials.

C. *At play*

1. Choose safe places in which to play: playgrounds, vacant lots, public parks, or your own backyard.
2. Avoid throwing broken glass or tin cans on the beach or on the playground. Pick up such articles when you find them in places where they are likely to be dangerous.
3. Do not throw stones or gravel.
4. Coast in safe places. Do not coast in the street unless it is reserved for coasting and properly protected from traffic.
5. Do not slide or skate on thin ice.

Poison ivy

6. Go wading or swimming only in safe places.
7. Learn to swim under safe conditions.
8. Avoid accidents in boats and canoes.
9. Learn to recognize and avoid poison ivy and other poisonous plants.
10. Do not eat berries or fruit which may be harmful.
11. Do not play with firearms.

D. *At home*

1. Avoid all possibilities of accidents from matches or fire.
2. Avoid accidents from electrical fixtures. Never touch an electric fixture with wet hands, or while standing in the bath tub, or while handling the telephone or any other electrical appliance.
3. Avoid accidents from gas.

4. Use a step ladder or a firm chair when you need to reach something high.
5. Put playthings away so that others may not trip and fall.
6. Smooth out the corner of a rug if it becomes accidentally turned up.
7. Put fruit peels in the proper place; never leave them where they may cause a fall.
8. Be careful in the use of scissors, knives, needles and pins.
9. Treat all cuts and scratches promptly.

Things You May Like to Do

1. Discuss in class each of the above groups of rules.
2. Add as many more rules as you can to each group.
3. Organize a Safety Patrol to help avoid street accidents while children are coming to and going from school. (The National Safety Council, 1 Park Ave., New York City, will be glad to furnish information upon request.)

IV

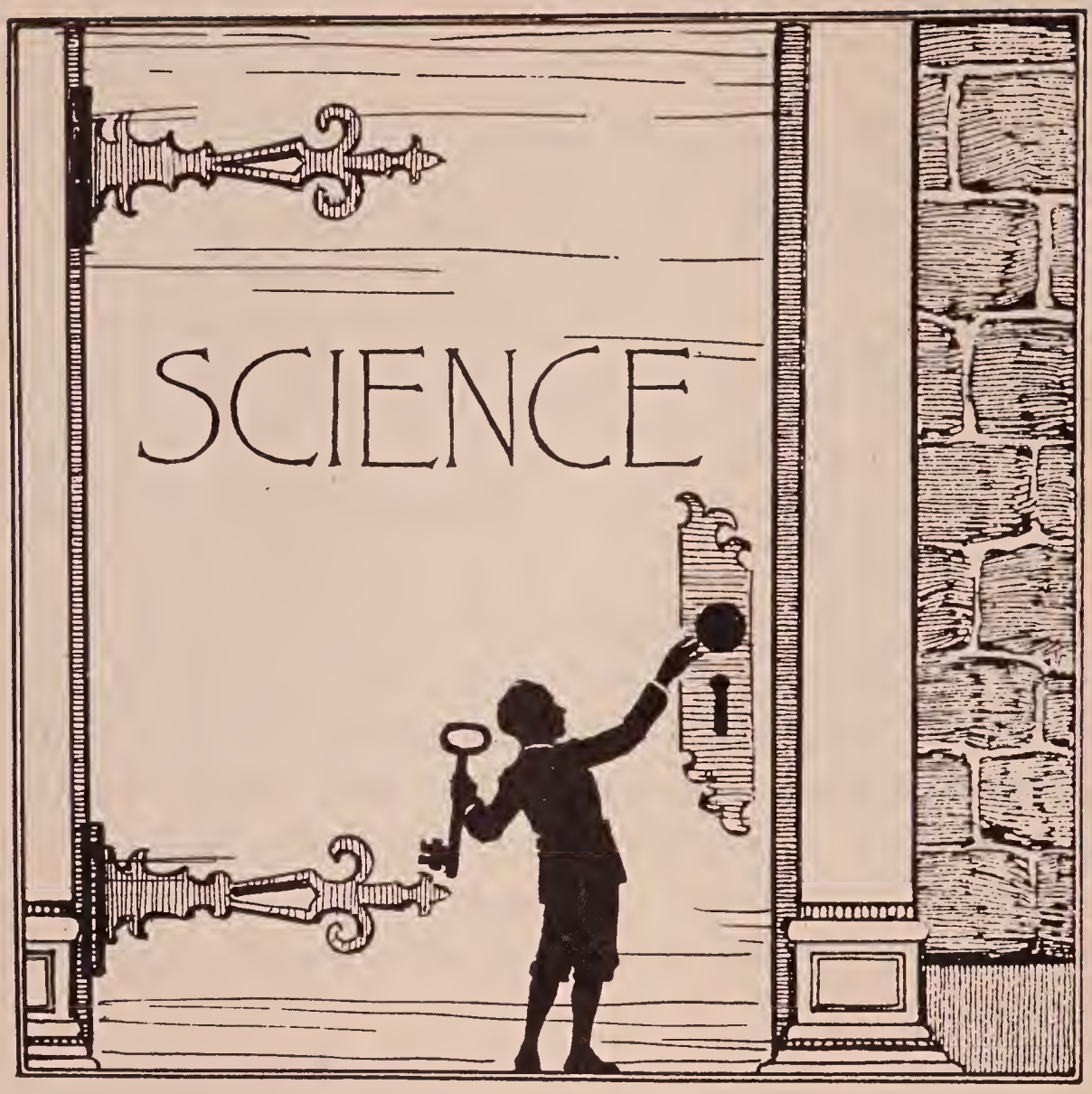
WHAT IS CLEANLINESS?

If you were to define cleanliness, you might say that a thing which is clean is free from dirt. That definition is correct if you understand what dirt is. Just what do you mean by dirt? Where does it come from? What does it do?

Soil.—Soil is sometimes called dirt; there are many different kinds of soil, however. What you call sand is made of particles of rock. Gravel is made of coarser pieces of rock, often mixed with sand. Clay is finely ground rock. The term "dirt" is not so often applied to these. Very likely you speak of clean or dirty sand, according to whether or not it is free from other materials.

The word "dirt" is most often used in speaking of garden soil. This contains sand, clay, or gravel, but it also contains humus, a substance produced by the decay of plant and animal matter. Humus is the source of food for plants. Plants will not grow in pure sand, gravel, or clay, for these soils contain nothing upon which they can feed.

When you say that garden dirt is "rich," you mean that it contains a large amount of these made-over substances. In the woods you have seen how this kind



Through science we learn the way to health.

of soil is made. The ground upon which you walk is covered with leaves. If you dig down a little way, you find that the old leaves underneath have decayed, forming a black humus soil. Children who are familiar with gardens or farms know that the richness of the soil is increased by adding fertilizer.

Living things in garden dirt.—Garden dirt also differs from sand, gravel, or clay because it contains

Grass seeds compared with beans in size

things which are really alive. Even if seeds are not planted, grass and weeds will come up, because the seeds of these plants are already in the dirt.

There is a great difference in the size of seeds. You may have planted garden seeds like beans or corn. Perhaps some of you have seen grass seeds, which are very much smaller. They are not to be found on blades of lawn grass which is kept closely cut. If this grass were allowed to grow tall, however, as it does in the hayfield, seeds would be formed at the top of the stalks. You can understand how hundreds of these tiny seeds may exist in a cupful of garden dirt without ever being noticed.

Garden soil contains the still smaller "seedlike" parts of such other plants as mushrooms. You are probably familiar with the mushrooms which are used as food or

Mushrooms

with the so-called toadstools found in the fields and woods. Do you know how their "seed parts" are formed? If you will bring a full-grown mushroom to school, break off the stem, and leave it bottom-side down on a piece of paper for a few days, you will find that a partial "picture" of the underside of the mushroom has been left on the paper. The lines of this picture are made of a kind of "dust."

Spore print from a mushroom

If you could look at some of this "dust" under a microscope, you would see that it consists of little rounded forms, which are too small to be seen by the naked eye. They are *spores,* which have dropped from the under side of the mushroom, thus making a picture, or "spore print."

Spores serve the same purpose as seeds; that is, they produce new plants like the one from which they came. Ferns, mosses, molds, and other plants produce spores instead of seeds. All spores have the fineness of dust and can be carried about in moving air. You can see, therefore, that the spores of many plants may be hidden in a spoonful of garden dirt.

Molds and bacteria.—Mold plants are near relatives of mushrooms. When mold spores settle on food,

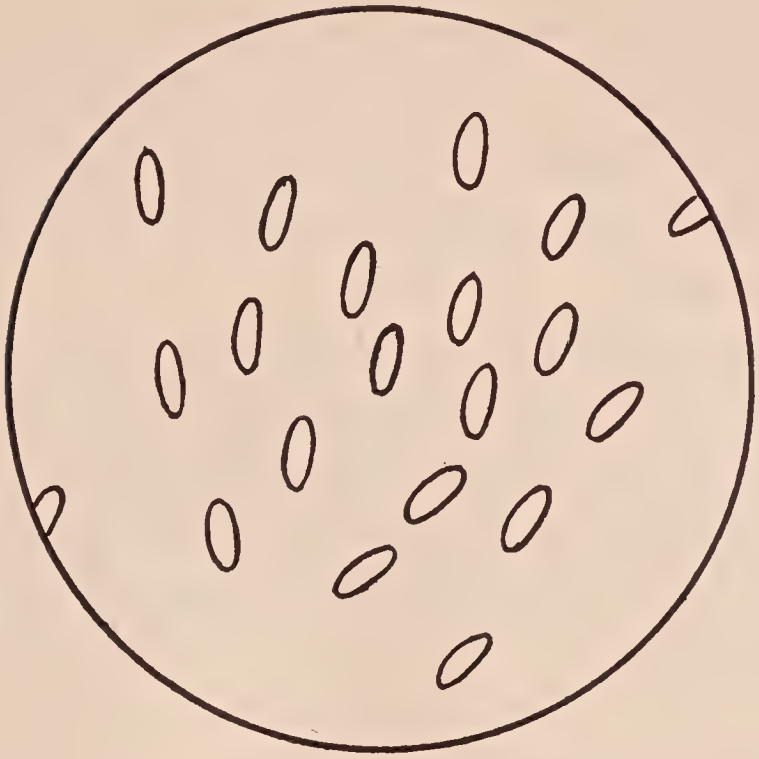
they grow, forming the mold which many of you have seen on spoiled food.

Other plants, still smaller than mold, are found in dirt. These are the bacteria. They are never large enough so that a single plant can be seen by the naked eye; they are seen by the use of a microscope. Every teaspoonful of garden dirt contains thousands of bacteria. These tiny plants are very useful in transforming the material of the dirt into substances which can be absorbed as food by the roots of larger plants.

The surface of the earth contains living things to a depth of several feet—both plants and animals. How appropriate it is for scientists to speak of "the living earth."

Dust.—Garden soil is not the only kind of dirt, however. The dust which gathers in a house is dirt. If you could see some classroom dust under the microscope, what would you find? There might be chalk dust from the blackboard; dirt from the floor, partly brought in from outside and partly made from the wearing away of wood and leather; bits of dandruff from the hair; lint from the clothing; particles of smoke and soot. Bacteria and spores of mold would probably be there also. These tiny plant bodies cannot *grow* in the air or in the dry dust, but they may keep alive there until they land upon some food where they can develop.

Other kinds of dirt.—Another kind of dirt is that which collects on your hands. It may be dust, oil, grease, paint, or soil. The entire body becomes dirty



Mold spores highly magnified

unless it is bathed frequently. Some of this dirt is waste left by the perspiration as it evaporates.

You may think also of dirt in water. Clay in water makes it look turbid. Iron particles make it look rusty. Tiny green plants, called *algæ,* are sometimes found in water. They are too small to be seen by the naked eye, but when present in great numbers they give the water a greenish color. Leaves, roots, and other parts of plants often give water a yellow color and, like the algæ, make it taste or smell bad. Almost any kind of dirt may get into water.

Dirt also gets into food, and, as you know, food spoils quickly if it is not kept clean. The part of dirt which makes food spoil is the living part, bacteria and molds. For example, apples spoil, rot, or decay. If

they are left under the tree to rot, after a time they seem to have disappeared. They have turned back to soil again. The changing of waste substances back into soil is not done by magic, but by these tiny plants called mold and bacteria.

Cleanliness defined.—Cleanliness is the absence of dirt. The object of this chapter has been to point out that dirt usually consists of living things as well as non-living substances, and to show that some of these living things are most useful in changing waste products to humus soil.

Questions for Discussion

1. What is the difference between garden dirt and other kinds of soil?
2. What kinds of living things are found in garden dirt?
3. What other kinds of dirt do you know besides garden soil? Do these kinds of dirt contain living things, too?
4. What happens to the leaves that drop to the ground year after year?
5. What makes fruit rot or decay? If fruit is left lying on the ground, what becomes of it?

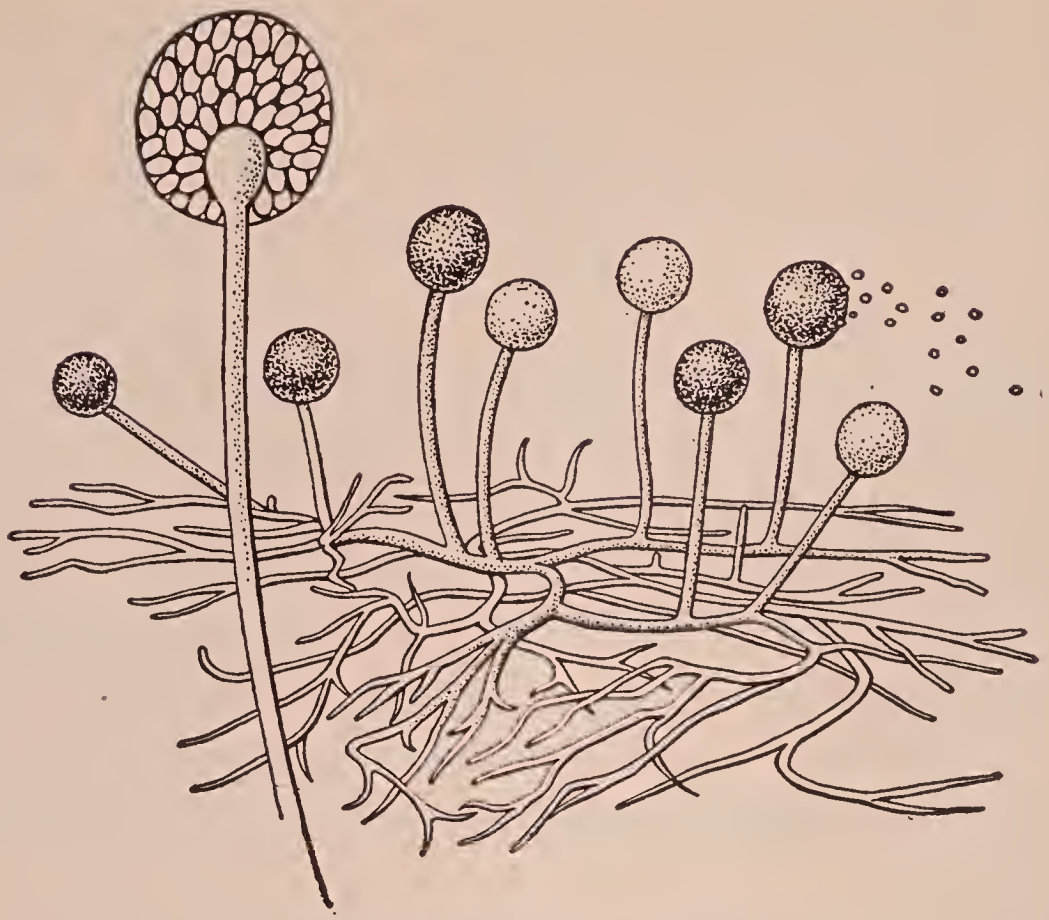
V

MOLD

What is mold? A few hundred years ago no one knew much about the nature of mold beyond the fact that it appeared "mysteriously" in various places and spoiled food, making it taste distinctly bitter. Today the botanist tells us that mold is a plant and that there are many different kinds, or species, all included in the group of plants which together are called the fungi (fun'ji). A single plant of this kind is called a fungus (fun'gus).

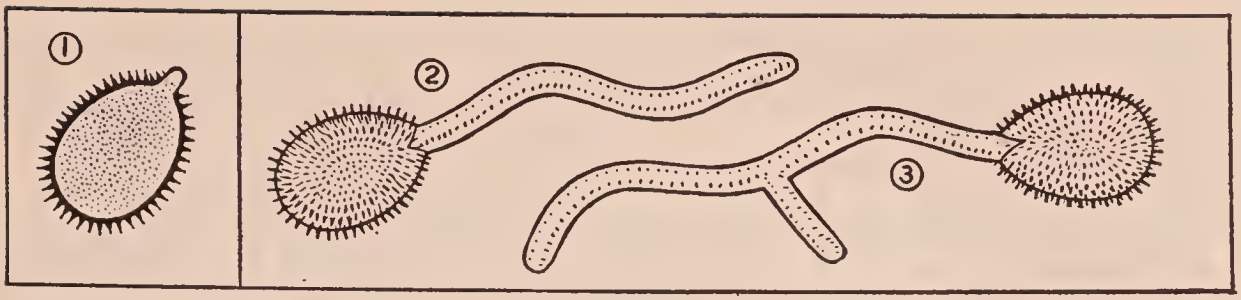
Fungi.—A fungus is a plant which is dependent. It cannot manufacture its own food from the substances of the soil and the air, as green plants manufacture theirs, with the aid of sunlight; but it must have its food already manufactured. In this respect the fungus is more like an animal than it is like the green plants. Neither a fungus nor an animal can stick "roots" into the ground and grow like a tree.

The mushrooms are fungi. They are the largest of the family. You find them growing upon decaying wood, in the decaying substances of very rich soil, or wherever there is plenty of manufactured food for them. The molds are much smaller fungi. To the naked eye they look like a fine white or colored fuzz.



Mold plant enlarged

How mold grows.—Where does mold come from? Some people think that it appears mysteriously in damp, dark places where food and similar substances are left. Science teaches us that it does not appear mysteriously at all. Each mold plant produces thousands of spores which drop from the plant and form part of the dust. They are so numerous that there is hardly a bit of dust anywhere which does not contain some. They are distributed by the wind and in every other way by which particles of dirt are carried from one place to another. Wherever these spores find food and conditions suitable for growth, there they develop into mold. Such plants



A mold plant starting to grow from a spore

are more or less like weeds in a garden. Nobody plants them purposely, but so many "seeds" are scattered about that the "weeds" come up whenever they get a chance.

With a hand magnifier or reading glass you can learn more about the structure of mold. You will see that what looks like a fuzz is really a mass of white threads. Some threads run along the surface of the substance upon which the mold is found. Others grow a short distance down into the substance itself. As the mold becomes full-grown, some threads grow up into the air. At the ends of these threads spores are produced. They grow only a very little distance above the rest of the plant, yet spores are so light that when they drop there is a good chance of their being caught and carried about by a slight breath of air.

It is possible to plant spores upon gelatin, then place them under the microscope and study them at the different stages of their development. One sees in this way that the whole mold plant comes from a single spore. The spore breaks open and a thread grows out. This first thread takes food from the material upon which it is located, and grows very rapidly, branching into a tangle of threads. At first the mold is white, but later

A reading glass

it may become green, blue, or black as the spores are formed. Spores look practically clear when seen under the microscope, but they do possess enough color so that when they are seen in a mass the color appears.

Have you any idea of what mold is made? The walls are made of a substance like that found in many parts of the green plants. Inside the walls is the "living stuff" of the plant. If you could weigh a piece of mold carefully and then dry it completely and weigh it again, you would find that in removing the water through drying you had taken away more than nine-tenths of the weight of the plant.

How food molds.—What kinds of food mold most readily? You immediately think of bread or jam. Make a list of other foods which you have known to

mold. Then make a list of foods which do not mold easily, such as sugar, dried beans, or dried fruit.

Look over your two lists and compare the foods. You find that foods which do not mold are dry, and that those which mold easily contain more or less moisture. Although dried beans do not mold, baked beans or cooked beans mold quickly. Even dried beans will mold after soaking in water for a time. In fact, perhaps most of the dry foods in your list would develop mold if kept in a damp place. A gardener knows that each plant has certain conditions under which it grows best. Moisture is necessary for the growth of the mold plant.

What other conditions favor the growth of mold? Think whether it grows better in the dry attic or in the damp cellar; in the dark or in the sunlight; in a closed dish or in an open dish exposed to the light and air. Darkness as well as dampness favors its growth. It can grow in daylight, but direct sunlight kills it.

Temperature also is important. At what time of year do you have the most trouble with mold—in summer or in winter? Does food mold more quickly or less quickly in a refrigerator? Experience has probably taught you that mold requires a certain amount of warmth. Food will mold even in a refrigerator after a time, but it will not mold so quickly as in a warm room.

For every living thing there is a range of temperature at which it grows best. Temperatures between seventy and one hundred degrees Fahrenheit are best

for the growth of mold. Do you have any idea how warm that is?

Mold cannot stand very high temperatures. You would never think of mold growing in a hot oven. It would be dried up and killed. Some mold spores can resist a certain amount of boiling, but when *cooked* food molds, it is nearly always because the mold spores have reached the food after the cooking process.

Mold requires, then, first of all, some manufactured food. In addition to that, it needs dim light or darkness, plenty of moisture, and the right degree of warmth. All these facts are important in considering the place of mold in our everyday life. Food is prevented from molding by keeping it clean and by some such process as drying, cooling, cooking, or exposing to sunlight.

The growth of mold in other places.—Do not make the mistake of thinking that mold is to be found only upon food; it is to be found in many other places. Leather molds. Harnesses left undisturbed in damp barns frequently gather mold in the summer. At the seashore, people sometimes find mold on shoes which have been put away for a long time. Gloves mold under right conditions and are often spoiled by the little mold spots left upon the leather. What experience have *you* had with the molding of leather goods? How can leather be protected from mold?

Mold may grow on clothing, too. This happens most commonly when damp clothes, which have been sprinkled for ironing, are allowed to lie rolled up for

a day or two during warm weather. The mold first appears as tiny white spots, which later turn dark in color. This type of mold is called *mildew*. Does it injure the clothes? How does your mother protect clothing from mildew?

If wood is in a damp place and unprotected by varnish or paint, it is likely to mold. A house which has been shut up for a long time often smells musty because of mold about the rugs, curtains, and furniture. How does one get rid of the musty odor?

Useful molds.—We think of mold as a pest. It is like a weed in the garden. Yet, as you know, certain molds are useful in turning waste substances back into soil. Other kinds of mold are definitely useful to man. In making strong cheeses, the right kind of mold is purposely allowed to grow in the factory and get into the cheese. It gives to cheese a strong flavor which many people like.

How to study mold.—Bring specimens of mold into class for your next lesson. If you can find any moldy food at home, keep it carefully covered and bring it to school *just as it is*. Do not try to change it from one dish to another, because the little mold plants may be crushed or spoiled so that you cannot study them at all.

If you cannot find any mold, try to grow some. Choose a food which molds easily. Smear it over with dust or dirt. Supply it with the conditions which help mold to grow—moisture, warmth, darkness. The

greater number of specimens you have in class, the greater is your chance of seeing all the things you want to observe.

Bring magnifying glasses also. The large reading glass with a handle is best, but if you cannot get one of these, bring whatever you have. Even a small magnifier is very helpful.

In the meantime, talk with your mother about mold. Find out what she does to keep her pantry free from it. Bring your information into class for discussion.

Things You May Like to Do

1. Try some experiments to see the effect of different conditions upon mold.
   - *(a)* Set one dish of mold in the direct sunlight. Put another away in the dark. Observe which grows better.
   - *(b)* Leave two dishes of mold beside each other, one covered and the other uncovered. Observe the effect of drying.
2. State the most important facts about mold in brief sentences.
3. Make a set of rules showing how to care for food so as to prevent its molding.
4. Study the moving picture "Mold and Yeast" (Eastman Teaching Films) if it is available.

VI

BACTERIA—THE SMALLEST PLANTS IN THE WORLD

Bacteria take part in many common processes which are going on about us. For example, they cause milk to sour. If you ask a person why milk sours, he may say it is because the milk is left in a warm room and that it will not sour so quickly if you keep it cold. What he says is true, but the souring is really due to certain bacteria which grow in the milk. They feed upon the milk and manufacture an acid (lactic acid). The milk sours more quickly in a warm room than in the refrigerator

because these plants, like most others, grow more rapidly where it is warm.

This is only one example of an important process carried on by these plants which are too small for the human eye to see. It will be interesting to learn something of the microscope, by means of which man has been able to see these plants and to study their nature and activities.*

The microscope.—If you have ever looked through a magnifying glass, you know that it makes an object appear larger than it really is. Through the glass you can see smaller parts which you could not see at all before. The compound microscope is a combination of magnifying glasses which makes a tiny object appear several hundred times its actual size. It is one of the most useful tools of science today.

You can easily understand that the invention of the first compound microscope made it possible for man to see things he had never seen before. It has revealed a great many little plants and animals so small that their existence had been unknown. Is it not strange to think that through thousands of years of human history man was without a knowledge of these living things?

Mold was one of the first things studied with the compound microscope. The yeast plant, a relative of

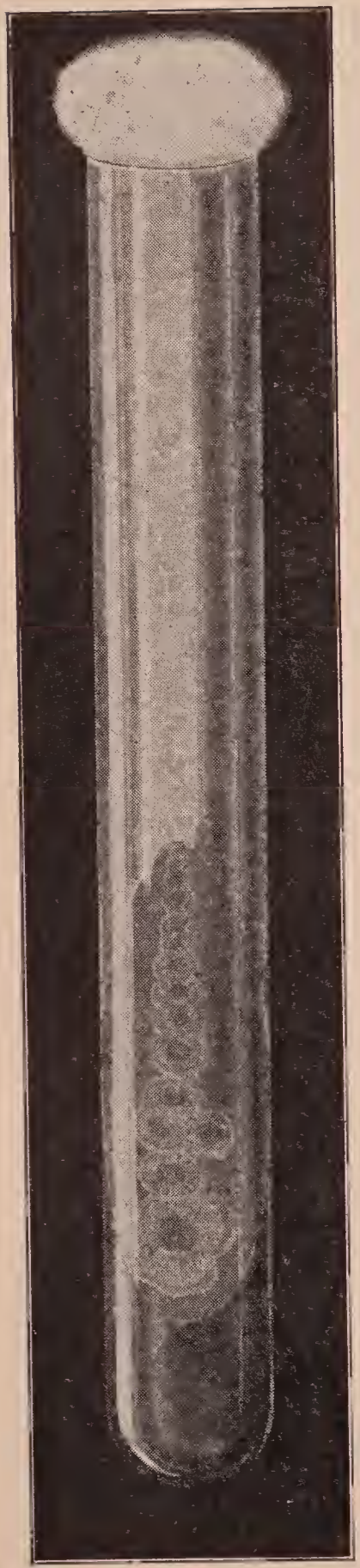
* The School Health Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York City, has issued a unit of work on bacteria, which was prepared under the supervision of one of the authors of this book, and which suggests many pupil activities in addition to those mentioned in this chapter.

Upper pictures show the appearance of living bacteria. The lower pictures show bacteria which have been stained or colored with dye. 1 and 2, cocci; 3 and 4, bacilli; 5 and 6, spirilla.

mold, was studied with great care. It was found to be present in every fermentation of alcohol, such as the process of wine-making.

Bacteria.—Bacteria do not have roots, stems, or leaves, as the large plants do. In fact, they are even simpler than mold. Seen under the microscope they are colorless and nearly transparent, although in large masses they often have some definite color.

They are separated into three great groups, according to their shape. The cocci (coc'si) are round like marbles. The bacilli (ba sil'li) are rod-shaped or sausage-shaped. The spirilla (spi ril'la) are curved like the letter S.



The conditions under which bacteria grow best are the same as those for mold. There must be some substance from which the bacteria can take the food they need for growth; there must be a certain degree of moisture, darkness, and warmth. Some bacteria can withstand cold. Some can withstand a fairly high temperature. All bacteria are killed by direct sunlight and by sufficient boiling or baking.

The method of growth is simple. When a bacterium finds itself under the right conditions, it grows, or becomes larger, just as any plant does. As it reaches a certain size, its body wall contracts around the center. This contraction increases until the plant breaks apart, making two in place of one. This process of multiplication (growth and division) continues indefinitely, so long as conditions are favorable.

Under favorable conditions bacteria can divide as often as once every fifteen minutes, until they become so numerous as to interfere with each other or use up the food

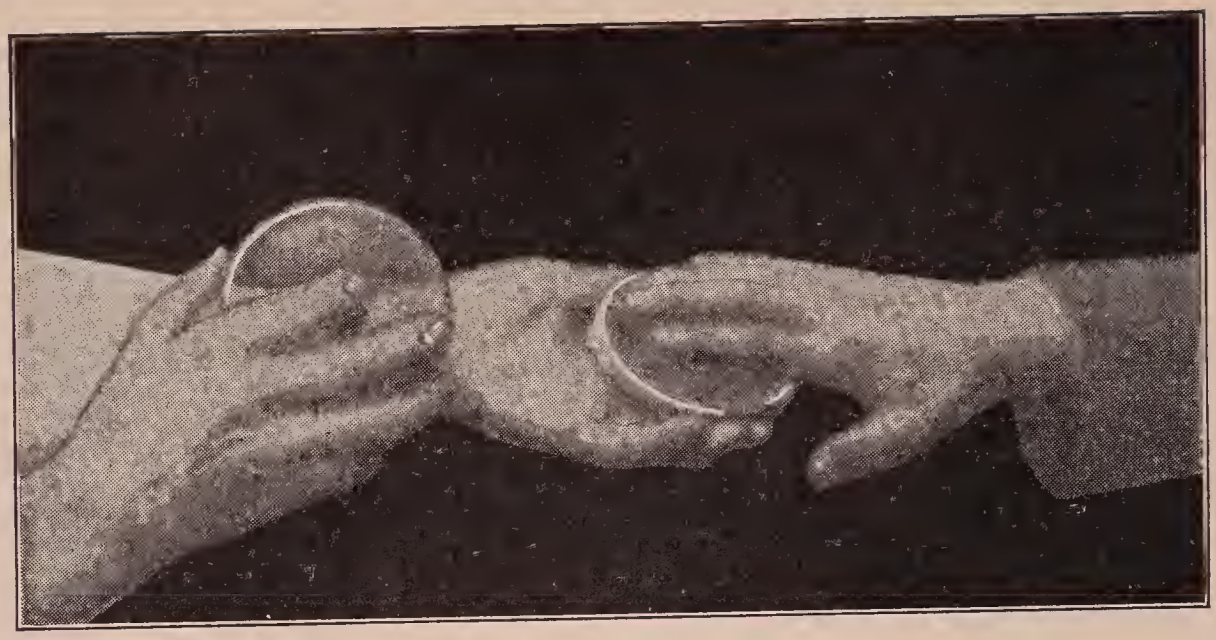
supply which is within reach. Starting with a single bacterium, how many bacteria would there be at the end of five hours if each new cell divided into new ones fifteen minutes after it was produced?

Five hundred of the largest known bacteria, if arranged end to end, would measure only one inch; that is, a single plant is one five-hundredth of an inch in length. Some of these plants are so small that it would take five thousand of them to measure one inch. Thirty trillions weigh on the average only about two ounces.

Many of these plants have no power of movement, but some of them can swim about in water. The most active of them can move about twelve ten-thousandths of an inch a second. If man could move at the same rate in proportion to his size, he would be able to run more than a mile a minute.

What bacteria do.—Because they can increase in number so rapidly and because of their small size, bacteria are found widespread throughout the world. They are in garden dirt, in dust, in air, in water, and even in the digestive tract of the human body. Most of them are as harmless as grass and flowers. Some of them are very useful.

For example, cider is changed to vinegar by the growth of bacteria. The "mother" of vinegar is made up of a mass of the tiny acetic acid bacteria. You have already learned that lactic acid bacteria cause the souring of milk. Ordinarily this is not helpful, but in the making of certain kinds of cheese, and in start-

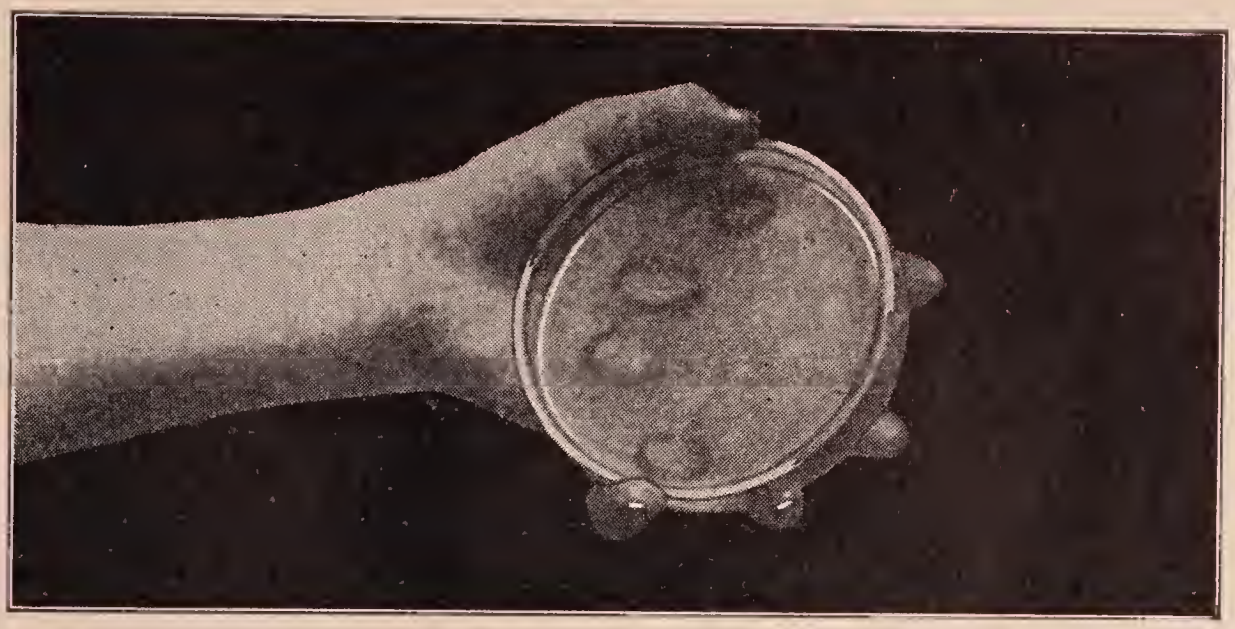


Planting bacteria from dust on the finger tips

ing the churning of butter, lactic acid bacteria are useful.

You have heard that hemlock bark is used in tanning leather. Certain bacteria which feed upon the juices of hemlock bark ferment these juices or "act on the bark" to produce the tannic acid which "tans" the leather. Still other bacteria assist in the making of linen fibers from flax. Countless bacteria live in the upper layers of the earth, helping to transform plant and animal substances back into soil, and preparing the substances of the soil for use by the larger plants.

There are varieties of bacteria which are as harmless and as little known by people generally as the wild flowers of the forest. There are other bacteria, like those which cause food to spoil, which are nuisances, but which are not harmful. Only a few are really injurious to man. Through the science of bacteriology we are gradually learning to avoid and control those



In two days the few bacteria left by the finger tips have grown into colonies large enough to be seen by the naked eye.

which are harmful, and to make the useful ones of still greater service.

Have you ever heard the word *microörganism?* This really means any living thing which is so small that it can be seen only with the microscope, whether it be a microscopic animal or a microscopic plant like one of the bacteria. You are probably more familiar with the word *germ* or the word *microbe.* Both words originally had the same meaning as *microörganism,* but many people now use these words in speaking only of the *harmful* microörganisms. No one of these three words names a particular group of plants as does the word *bacteria.* In all our classroom work, then, let us use the correct word and call them *bacteria.*

Studying bacteria.—In order to study bacteria, it is necessary to grow them, just as the botanist may need to grow the plants which he wants to become

acquainted with. Instead of growing bacteria in soil, scientists use specially prepared substances called *media.* One of the most common forms of media is gelatin —not very different from the gelatin of which puddings are made at home. Another kind of media, called *agar,* is made from seaweed and is very much like gelatin. Sometimes bacteria are grown in liquids like beef broth or dissolved sugar. The value of using gelatin or agar comes from the fact that it hardens as it becomes cool, and thus separates the bacteria and keeps the descendants of each plant in one spot instead of allowing them to float about. A special growth of bacteria is called a *bacterial culture.*

Questions for Discussion

1. What are bacteria?
2. What shapes have they?
3. What conditions favor their growth?
4. Where are bacteria found?
5. How do they increase in number?
6. In what ways are bacteria useful?
7. What are media?
8. What is a bacterial culture?

Things You May Like to Do

1. The making of media and the methods of studying bacteria in the laboratory are well shown for boys and girls in a moving picture called "Bacteria" (Eastman Teaching Films). Use this film for study if it is available.
2. Write in brief sentences the most important facts about bacteria and their growth.

3. Make some experiments with culture media if you are able to get some from your Health Department. Put into separate test tubes of sterile culture media: (1) dust; (2) a few drops of tap water; (3) dirt from under the finger nails; and (4) a pinch of garden soil. Put each tube in a warm, dark place for a few days and see whether bacteria grow from the material you have dropped in. (The unit of work on Bacteria available from the Metropolitan Life Insurance Company suggests several easy and interesting experiments.)

VII

PASTEUR AND A NEW SCIENCE

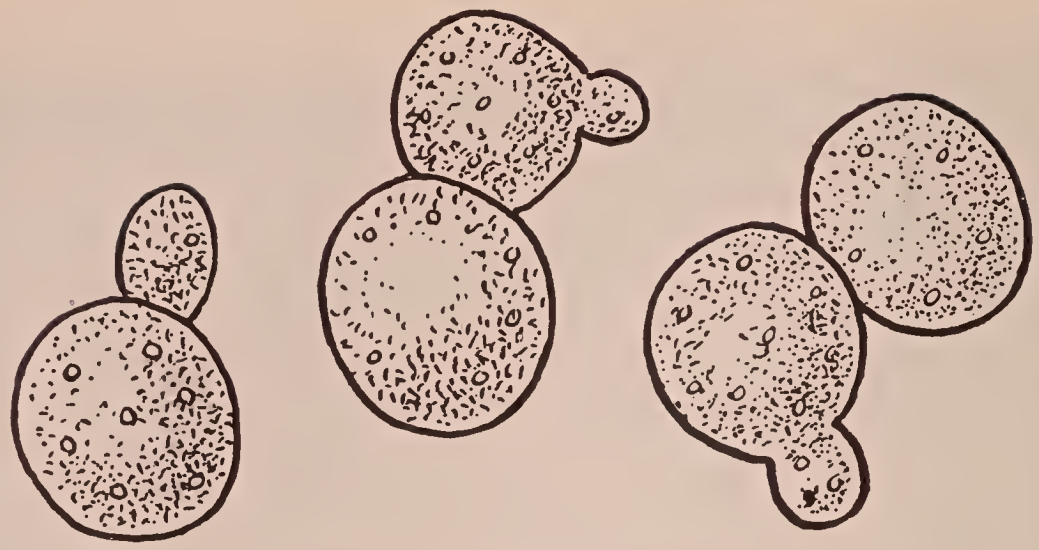
Louis Pasteur gave us our first really important knowledge of bacteria. He paved the way for a new science—bacteriology. The story of his life and discoveries is as thrilling as a great adventure.

Pasteur was not only one of the most famous Frenchmen, but one of the greatest scientists of any time or any country. He was born at Dole, France, December 27, 1822. His father was a tanner. Although his parents were poor and lowly in position, they were rich and noble in their qualities of mind and character. Pasteur himself became a most lovable man. With all his greatness he was not proud and haughty, but kind and sympathetic. He loved boys and girls and used to remind people that the great scientists of tomorrow are to be found among the school boys and girls of the present day.

Fermentation.—Pasteur was educated as a chemist, and his first work was on the chemistry of certain substances, the crystals of which he studied under the microscope. His more important work, however, dealt with the nature of bacteria.

Before the time of Pasteur, there was little knowledge of such microscopic plants as yeast and bac-

Pasteur



Yeast cells highly magnified

teria. The yeast plant had been seen under the microscope, but there was no definite proof that yeast causes the fermentation of alcohol.

Pasteur by his experiments proved that fermentation is due to the life processes of yeast growing in a sweet liquid. All animals and plants take food into their bodies and throw off waste products which they cannot use. The principal food of the yeast plant is sugar. Feeding upon sugar, it throws off alcohol and carbon dioxide as waste products. The carbon dioxide, being a gas, passes off from the liquid in which the yeast is growing. The alcohol remains.

Past generations have not understood the harmful effects of alcohol upon the body, and the use of alcoholic drinks was formerly quite widespread. At the present time, we recognize alcohol as one of man's most dangerous enemies. After reading about its injurious effects in Chapter XVI, you will see why it has seemed desirable

to prohibit the sale of wine, beer, and all other alcoholic drinks, which have brought so much sickness, hardship, and suffering to people in the past.

Pasteur's interest in fermentation grew rapidly, and he began to study the fermentation, or souring, of milk. He found that when milk sours, little gray patches can be seen on the sides of the dish. When he placed some of this material under the microscope, he found it to be made up of tiny globules even smaller than those of yeast. Whenever this material was transferred to fresh milk, the milk soured. These globules were bacteria, and this particular kind of bacterial plant is the "ferment" of milk.

Diseases of wine and beer.—Pasteur made other experiments with ferments by studying the "diseases" of wine and beer. In those spoiled liquors which had a sour or bitter taste he found, in addition to the yeast, little rod-shaped bodies (bacteria). He explained to the manufacturer that these bacteria get into the vats where wine or beer is being made and start an unhealthy fermentation. He discovered also that these diseases or bad tastes are not developed if the wine or beer is heated just enough to kill the bacteria. Thus it came about that the name "pasteurization" was given to the process of heating liquids sufficiently to kill any undesirable bacteria which may be present. Thus originated the process so widely used today to kill bacteria in milk.

Pasteur had proved for all time that these different

kinds of fermentation are caused each by its own ferment and that each ferment is a living plant. He could not help raising in his mind this question: "If some of these bacteria are the ferments which cause the diseases of wine and beer, is it not possible that other plants of this type may cause diseases in the bodies of animals?"

Diseases of silkworms.—About this time (1865), there was a disease among the silkworms in southern France. This was serious, because in many towns the raising of silkworms was the chief occupation of the people. The mulberry tree, upon the leaves of which worms were fed, was called the tree of gold, and the hurdles upon which the worms or caterpillars were kept were often placed in the best rooms of the houses.

When stricken by disease the worms would stop eating, wither, and die before they had formed their silken cocoons. It looked as though the whole industry might be ruined. For years the disease had spread and no one had been able to check it. Such useless remedies as dusting the worms with charcoal, sulphur, ashes, mustard, and sugar had been tried without avail. Pasteur was asked to study the disease. He knew nothing about silkworms, but he undertook to find out what was the cause of the disease, how it was spread, and how it could be controlled.

Other workers had found small, oval-shaped bodies in the sick worms. These they had called corpuscles. Pasteur found these with his microscope and recog-

Life history of the silkworm: 1, silkworm (larva) feeding upon mulberry leaves; 2, cocoons of the silkworm; 3, cocoon open, showing the pupa inside; 4 and 5, full-grown silkworm moths.

nized them as still another kind of bacteria. The presence of these bacteria and the waste products thrown off by them caused the disease of the worms. From

this knowledge Pasteur developed a method of growing silkworms under such conditions that only eggs of healthy moths were allowed to hatch, and thus the bacteria of the disease were excluded. The disease was stamped out and the industry was saved.

Other studies.—A still more interesting study by Pasteur dealt with a disease of cattle and sheep known as anthrax or splenic fever. Thousands of animals died from this disease each year in the various countries of Europe. Through the work of Pasteur the disease was put under control. He made other studies, too, regarding the nature of disease and methods of fighting it.*

To Pasteur, then, the world owes a great debt of gratitude. It was he who discovered the importance of various kinds of bacteria in their relation to man. Upon his scientific discoveries rest many of the important principles in the sciences of bacteriology, medicine, and surgery.

THINGS YOU MAY LIKE TO DO

1. Find out more about the life and work of Louis Pasteur.†

QUESTIONS TO ANSWER

1. Who was Pasteur?
2. What was the important work done by Pasteur?
3. What makes milk ferment, or sour?
4. What is "pasteurization"?
5. Describe Pasteur's work on the disease of silkworms.

* See Chapter XV.

† An interesting account of his life is published by D. C. Heath & Co. A free film strip can be obtained from the Metropolitan Life Insurance Co., New York.

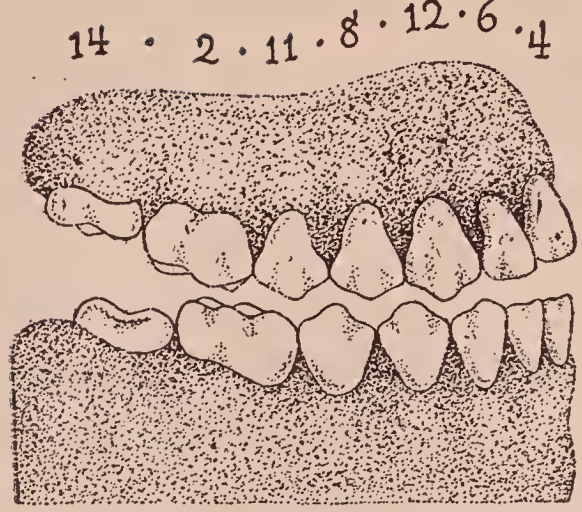
VIII

TEETH

So far as we know, man is the only animal who smiles. Perhaps he is the only animal whose teeth are an aid to beauty. He is also the only animal whose teeth commonly decay during early years of life. If you have had pets, you know that their teeth are clean and strong, and that decay or loosening does not usually appear until old age. Why is it that man, who smiles and is proud of his teeth, has teeth less strong than those of the lower animals?

You doubtless know already that bacteria have a part in tooth decay. From your present understanding of them you can easily see that the mouth furnishes conditions which are favorable for their growth. The action of bacteria in the decay of teeth is very important, but it is not the whole story. In order to find out exactly what happens, it is necessary to become acquainted with the nature of the teeth and the nature of decay.

The development of the teeth.—Every mother watches eagerly for the baby to cut his first tooth, which appears when he is about six months old. By the time he is two or two and a half years old, he has his first set complete—ten teeth on the upper jaw, and ten on the lower.



This illustration shows the teeth of a child twelve years old. The teeth come through in the order in which they are numbered, as follows:

(1) and (2)	Six-year molars	Fifth to seventh year
(3) and (4)	Central incisors	Sixth to eighth year
(5) and (6)	Lateral incisors	Seventh to ninth year
(7) and (8)	First bicuspids	Eighth to tenth year
(9)	Lower cuspids	Ninth to eleventh year
(10) and (11)	Second bicuspids	Tenth to twelfth year
(12)	Upper cuspids	Eleventh to thirteenth year
(13) and (14)	Twelve-year molars	Twelfth to fourteenth year

Do you know that the second teeth are formed within the jaw while the first teeth are still in use? These second teeth are larger and are made to last throughout life. In the second set, the first teeth which appear are the six-year molars; these come through just back of the baby teeth and are often mistaken for teeth of the first set.

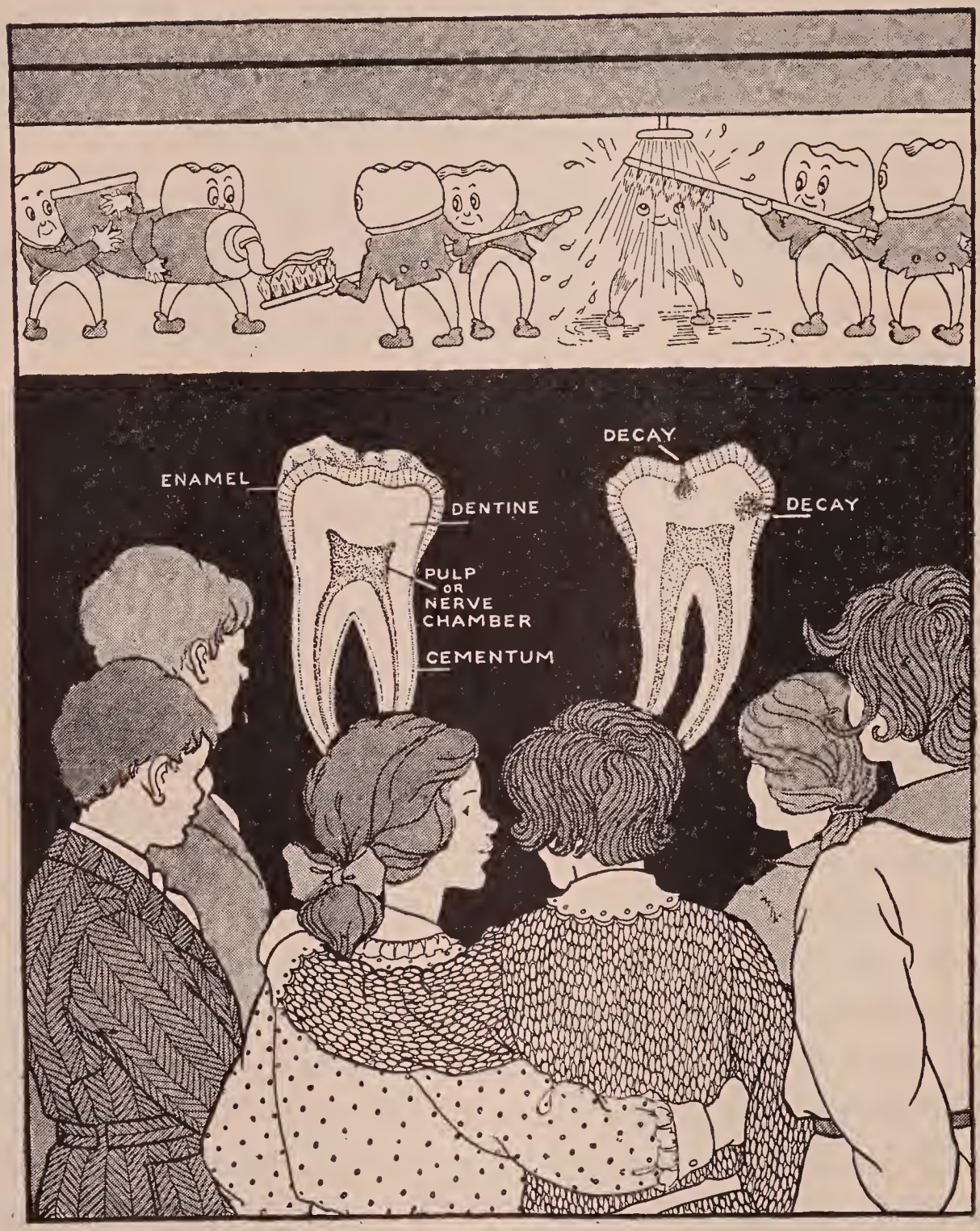
Between the ages of six and thirteen the baby teeth are all replaced with permanent ones. Between the ages of twelve and fourteen the twelve-year molars come through. The four wisdom teeth appear later at the age of seventeen, or older, and complete the second or permanent set of thirty-two teeth.

The structure of the teeth.—Teeth are made of a calcium compound. Calcium is the chief substance in lime and marble. Each tooth has two parts—the crown, which can be seen, and the root, which is below the gum. The outside covering of the crown is *enamel,* the hardest substance in the body. Beneath that is *dentine,* which forms the great bulk of the tooth, in both the crown and the root. The dentine is not so hard as the enamel.

At the center of the tooth is the *pulp cavity,* containing blood vessels and nerves. The nerves sense heat and cold, and through the blood vessels the pulp of the tooth is nourished.

Tooth decay.—As you consider the question of decay, keep in mind the fact that the hard mineral parts of the tooth were made from substances which the body secured from food. If the diet has been lacking in calcium, phosphates, and vitamin-containing foods, the dentine is soft and the enamel imperfect. Thus poor diet is often the beginning of tooth decay.

How are bacteria related to decay? Certain bacteria which live in the mouth change sugars into acids. If there is an opening or break in the enamel, these acids will slowly dissolve the dentine of the tooth as they do chalk or marble. Careful studies made at the Forsyth Dental Infirmary and at other places have shown that the enamel covering of most teeth is imperfect from the time the teeth are cut. These openings in the enamel are as tiny as pin points, but they



Longitudinal section of tooth

expose spots of dentine to the action of acid-forming bacteria, and here decay usually begins. Sometimes the enamel is cracked or the nerve of the tooth is injured by biting things which are too hard, as in cracking nuts or biting off threads. Picking the teeth with a pin is dangerous because it is likely to injure the gums or the enamel.

Dentine decays rapidly, and usually a tiny hole in the enamel means a much larger hole in the dentine underneath. As the hole in the dentine increases, the enamel may break away until the crown of the tooth is nearly gone; as soon as decay gets near the pulp, you have a toothache.

Preventing decay.—What can be done to prevent tooth decay? One important thing is to follow a diet which will furnish the material for building strong teeth. Teeth which have a thick covering of enamel and are built from a good supply of calcium will resist decay.

Since the permanent teeth are all built during the early years of childhood, you can see how important it is to have tooth-building foods at that time. A good diet at any time will help to improve the quality of the teeth, but no amount of care in later years can make strong, beautiful teeth out of those which were poorly built in the first place. A house cannot be built of paper. No more can teeth be built from candies and cakes. A diet rich in milk, fresh fruit, leafy vegetables, and whole-grain cereals is the only source of good building-ma-

Milk is a tooth-building food.

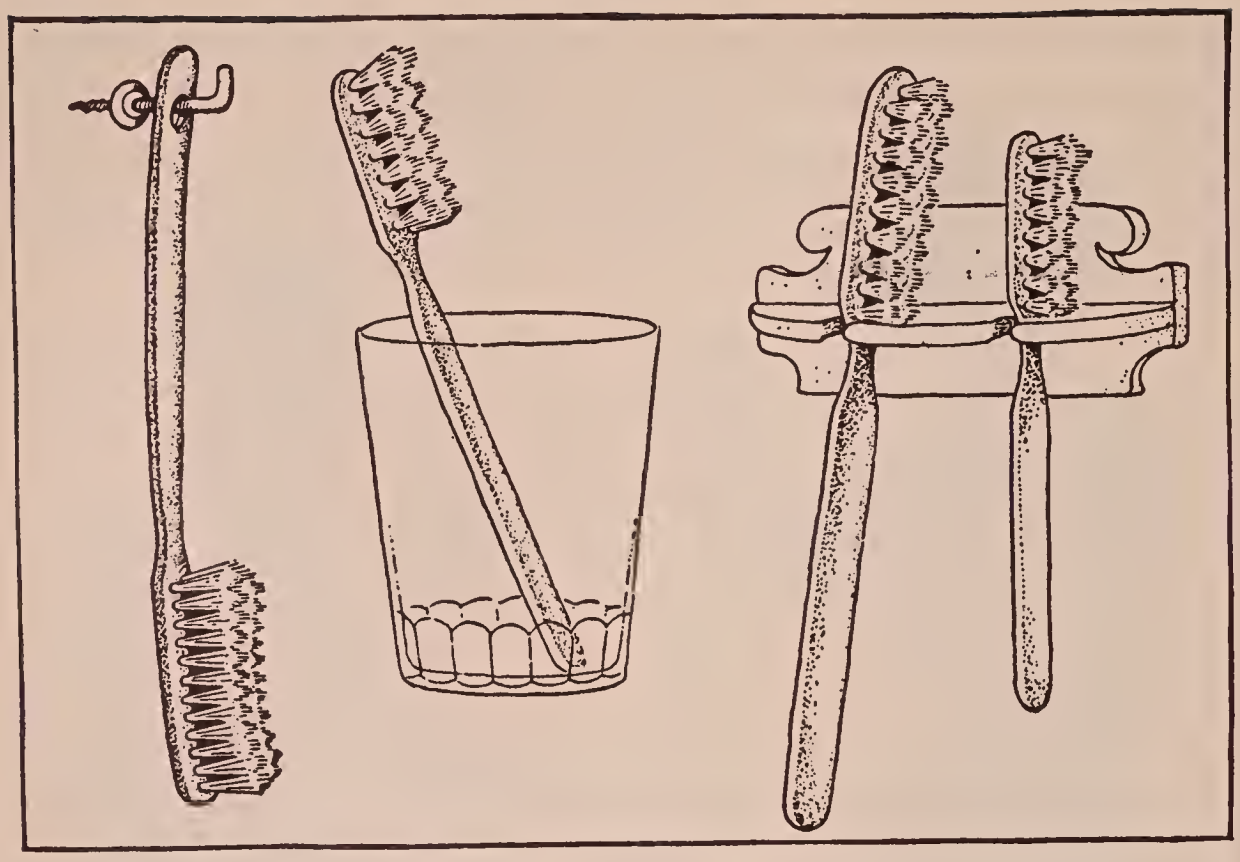
terials for teeth. Hard foods also help to build strong teeth, because they exercise the jaws. Try to eat at every meal some food which requires vigorous chewing.

The dentist plays a part, too, in saving your teeth. If you are cautious, you will give him a chance to do something more valuable than to pull out those teeth which have decayed; you will let him help you to *prevent* decay. Go to the dentist regularly so that he can

examine the teeth as they come through and repair any imperfections he may find in the enamel. He will clean and polish them, removing deposits which may injure the health of the gums. The tooth cannot repair itself; the dentist can repair it.

The toothbrush removes particles of food which might ferment and hasten decay. Use a brush which is stiff enough to clean your teeth thoroughly, and small enough to reach all parts of the mouth. Brush with an up-and-down stroke to remove particles of food lodged *between* the teeth. Be sure to clean all the surfaces of all the teeth. Brush your gums, your tongue, and the roof of the mouth, too. Your toothbrush is not merely a *tooth* brush; it is a *mouth* brush. Rinse your mouth thoroughly, swishing the water back and forth through the little openings between the teeth. If you use dental floss, be very careful not to tear your gums. Regular brushing and a good diet help to keep the gums firm, pink, and healthy.

Do you have regular times for brushing your teeth? From supper to breakfast is the longest time between meals, and brushing your teeth before going to bed is therefore most important. If you brush your teeth the first thing in the morning, you remove bacterial deposits which have formed on the teeth during the night. Perhaps you brush your teeth after each meal, too. This gives you the pleasant feeling of a clean mouth, which is one of the rewards of brushing the teeth regularly. Certain acid fruits, like oranges,



Care of the toothbrush

grapefruit, apples, and pineapple, help to clean your teeth at the end of a meal.

The care of the toothbrush.—Your knowledge of bacteria helps you to understand why each person should use his own brush, and why the care of the toothbrush is so important. After using it rinse it well, preferably in hot water. Then shake it and put it in a clean place to dry. If it is not rinsed and dried, bacteria may multiply in the brush itself. Drying the brush occasionally in the sunlight helps to keep it fresh and clean.

What is a *clean,* dry place for your brush? A closed toothbrush case, the edge of the washbasin, or a closed medicine cabinet is *not* a good place. Discuss in class different places where your toothbrush may be kept.

Why is it undesirable to keep one where it may touch a brush belonging to some one else?

The importance of saving the teeth.—Every tooth, whether temporary or permanent, is worth taking care of. The baby teeth are needed not only for chewing but also to enable the second teeth to develop properly. Nature intends that they shall last until the second teeth come through. If any of the second teeth are lost, especially the six-year molars, there is a tendency for the other teeth to drift.

Good teeth enable you to chew your food, to speak distinctly, and to present a pleasing appearance. Teeth cannot be satisfactorily replaced. Take good care of the ones you have.

THINGS YOU MAY LIKE TO DO

1. Explain the following rules for the care of teeth:
   - *(a)* Drink at least two glasses of milk every day.
   - *(b)* Eat leafy vegetables, fresh fruits, and whole-grain cereals.
   - *(c)* Eat at every meal some hard food which has to be chewed thoroughly.
   - *(d)* Brush your teeth at least twice a day.
   - *(e)* Keep your toothbrush clean.
   - *(f)* Visit the dentist at least every six months.
   - *(g)* Avoid injuring the teeth.
2. With the help of your teacher or nurse, make a general inspection of the class to discover how many pupils have teeth in the best possible condition; *i.e.,* clean and without cavities.
3. Carry on a campaign to get all dental defects corrected.

You may use an honor roll for those who bring a certificate from the dentist showing that all necessary repair work has been completed.

4. Use inspections or health-habit records to secure better habits of brushing the teeth regularly.
5. Interest your little brothers and sisters in caring for their teeth, and help them to save their six-year molars.
6. You may be able to get a model of the teeth from a dentist. A study of such a model will show the different kinds of teeth, how they are arranged, the places where food may be left, and the value of brushing with an up-and-down motion.
7. Study the moving pictures "How Teeth Grow" and "Care of the Teeth" (Eastman Teaching Films) if they are available.

IX

WHAT THE BODY IS MADE OF

How much would you take for your right hand? Would you sell your tongue for $10,000? Or your eyes for a quarter of a million? When you come to set a price on the different parts of your body, they seem very valuable. Are you taking care of your body as well as a thing of so much value deserves?

To take proper care of any complicated machine or instrument, one needs to know, at least in a general way, how it is made. Imagine that a beautiful watch, lost by an explorer, has been found by a savage. The watch with its regular ticking and moving hands would seem marvelous and wonderful, but what would happen when it ran down? The savage would have no idea of what was needed to make it go. He might hold it in the fire, pound it with a stone, or dance around it in worship. Probably it would never occur to him to wind it up and give it a shake, because he would not know anything about the way it is made or how it works.

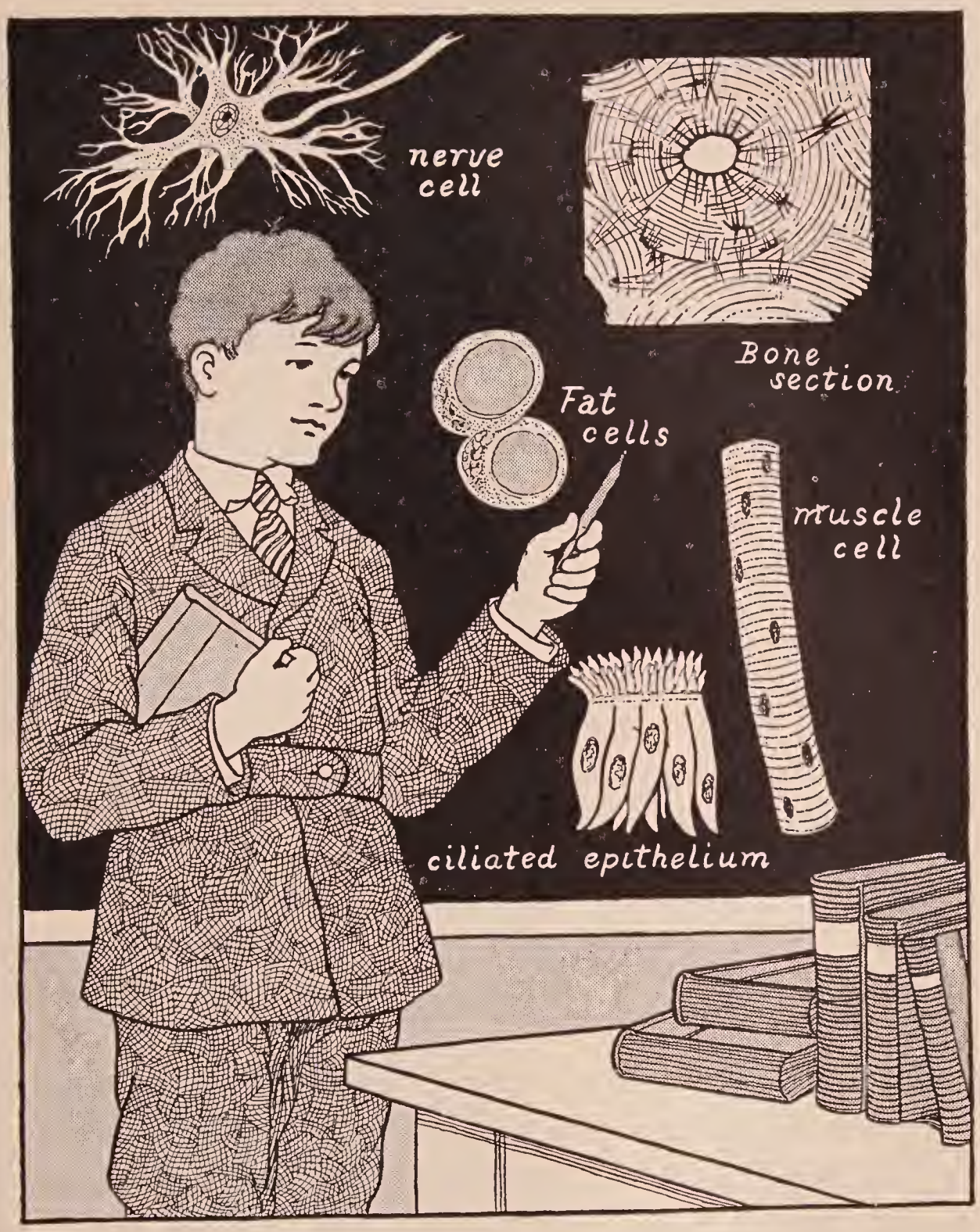
If you want to keep your body running perfectly without its "losing time," you need to know enough about its nature to take good care of it and keep it "going." It is not necessary for you to have a watchmaker's knowledge about a watch in order to take good care of it. Neither is it necessary for you to have a

physician's knowledge about the body in order to take good care of *it*. Your watch should be looked over by a watchmaker once in a while, and your body should be examined by the physician fairly often in order to have expert advice; but the job of running both the watch and the body and of keeping them in condition belongs to you. You will need to know, then, the general principles of the construction and operation of the human body.

Power for the human machine.—The power in a watch comes from the mainspring which is wound up every day. The power of a ship comes from burning coal or oil in the fire box. In an automobile the power comes from the burning of gasoline. The power for human activity comes from the "burning" of food.

There is one important difference, however, between the living mechanism—the body—and an ordinary machine. In a machine, the fuel is burned in one particular place and the power is transferred to the different parts. In the human machine, the fuel is not burned in a fire box, but in all parts of the mechanism. The digestive tract digests food but does not burn it. The stomach and intestines are the "workshops or laboratories" where certain foods are turned into fuel for the other parts of the body.

Of course there is no flame in the human body. Yet the fuel or energy foods which the body uses—sugar, starches, and fat—are substances which do burn with a flame outside the body. Perhaps burning food sub-



stances for body energy, then, is not entirely different from burning fuel for power in an engine.

The production of heat from the burning of foods keeps the body warm. Even when you go swimming

in cold water, or stay outdoors in cold weather for hours at a time, the body still keeps warm. In fact, the body automatically produces and loses heat with such perfect balance that its temperature remains at about 98.6° all the time. This temperature is so constant that it is regarded as a sign of health, and its variation is a sign of illness.

Building units—the cells.—In order to find out how the body develops its energy and uses its power, you need to know more about how it is made. You know that a building is constructed from different types of building units. The units are of various kinds, including bricks, building stones, planks, lathes, and windowpanes. They are grouped together in different places and in different ways.

This same principle of structure is found in the body. The skin, or any other part of the body, may seem smooth and without definite structure. If you could look at it through the microscope, however, you would see that it is made up of tiny building units arranged in a definite way.

The units in the body are called the *cells*. Cells in the body correspond to planks, bricks, stones, lathes, or windowpanes in the building. There are many different kinds of cells just as there are many kinds of building units. All parts of the body, including muscles, digestive tract, brain, nerves, heart, and even bone, are made up of these cells, either alone or in combination with substances produced by them. It is

within the body cells that the burning of fuel takes place.

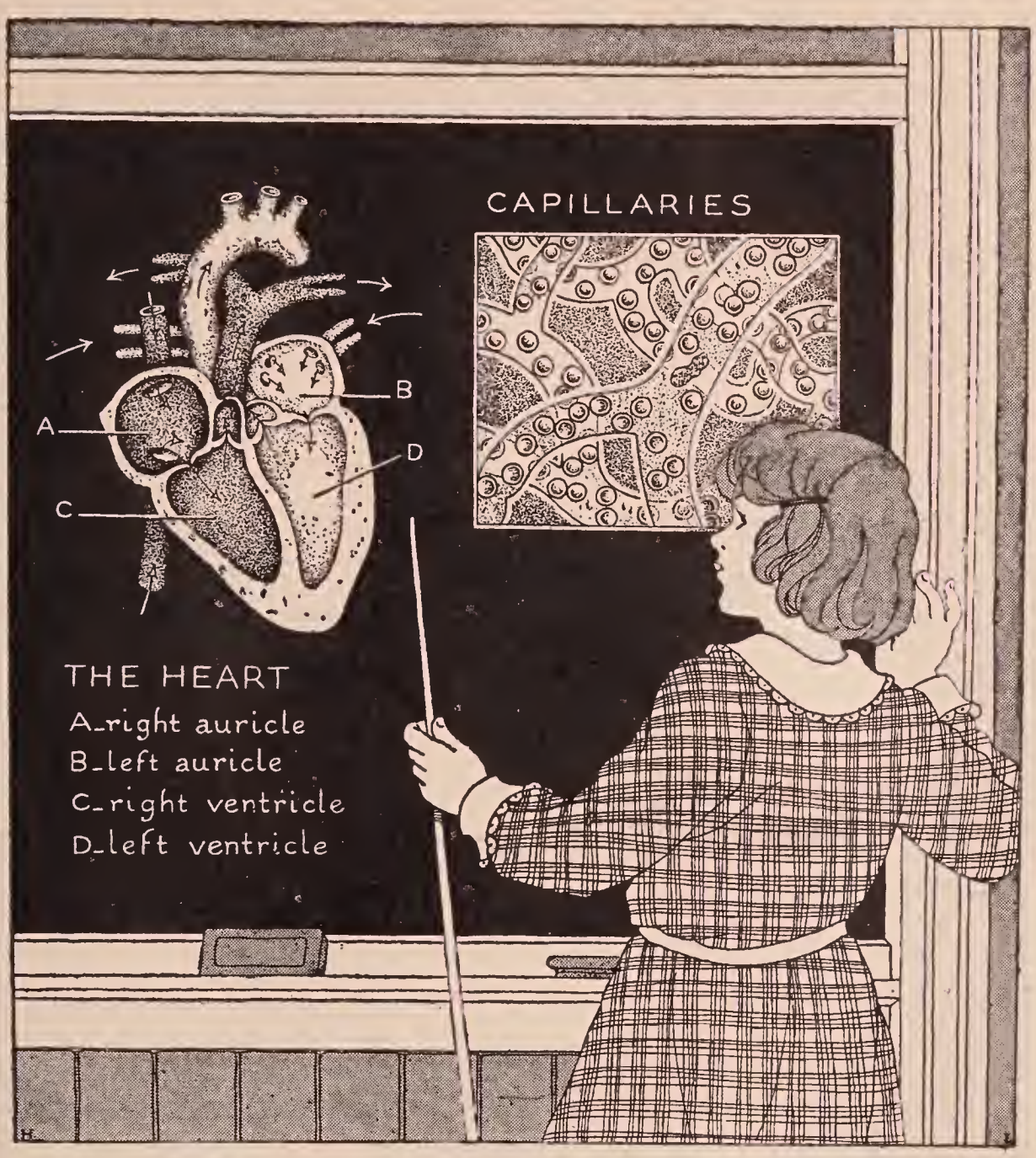
Cells differ widely in shape and in the use to which they are put in the body, but the material of which

living cells are made is much the same in all cases. It is the living stuff of the body, called *protoplasm*. None of the cells are large enough to be seen by the naked eye. When seen under the microscope they are partly transparent and look much like a bit of egg-white or a bit of clear gelatin.

Tissues.—Cells of the same kind are grouped together in the body just as building units of the same kind are grouped together in a house. A group of bricks make a wall; a group of planks form a floor; a group of windowpanes form a window. In the body a group of like cells form a *tissue*. You have probably heard of bone and muscle tissues. Other cells make up the tissues of the brain, nerves, glands, and other parts of the body. There are also connective tissues, the cells of which bind different parts together.

The transportation of substances within the body.—Water plays a very important part in the structure and functioning of the body. Not only does each cell contain a great deal of water, but the space between cells is filled with watery fluid. Digested food substances are dissolved in water; in this form they pass through the walls of the digestive tract and are carried to all parts of the body.

The transportation system within the body is a water-carrier system. The circulating blood is the most important part of this system, with the heart acting as a great pump to keep the fluid moving.



The heart is divided by a partition through the middle into a right side and left side, each having an upper and lower chamber. The blood is pumped from the right side of the heart through arteries to the lungs. Veins bring the blood from the lungs to the left side of the heart. From here it is sent to all parts of the body through another set of arteries. Veins bring the blood

back from the tissues to the right side of the heart. Capillaries connect arteries and veins.

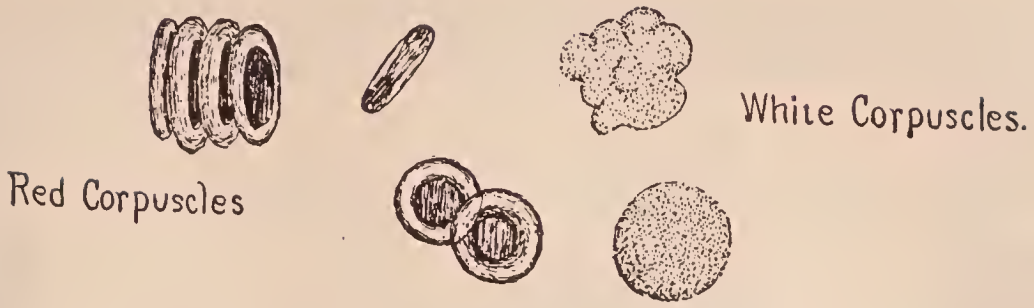
You can feel the pumping action of the heart if you put your hand on the artery of the wrist and "feel your pulse." You can see veins showing under the skin of the wrist or the back of the hand.

The blood is made up of a watery fluid in which red and white corpuscles are carried. The red blood corpuscles take oxygen from the lungs to all tissues of the body and carry back to the lungs the carbon dioxide, which is a waste substance. The white blood cells help the body to destroy some of the harmful bacteria.

Another thing which the blood does is to carry dissolved food substances throughout the body. The cells in the various tissues are bathed in fluids containing these dissolved foods. As each cell uses up its food and burns its fuel it gives off waste products. These return to the blood stream either directly or through special channels called *lymph vessels*.

Think of this as though each cell were a house with the blood stream acting as the grocery man who brings food. The waste is set out in the alley where it is collected by the ash man—the lymph.

Removal of waste.—But, you say, what happens to these waste products when they get back into the blood? One waste product is carbon dioxide, which is thrown off through the lungs. The kidneys remove another kind of waste.



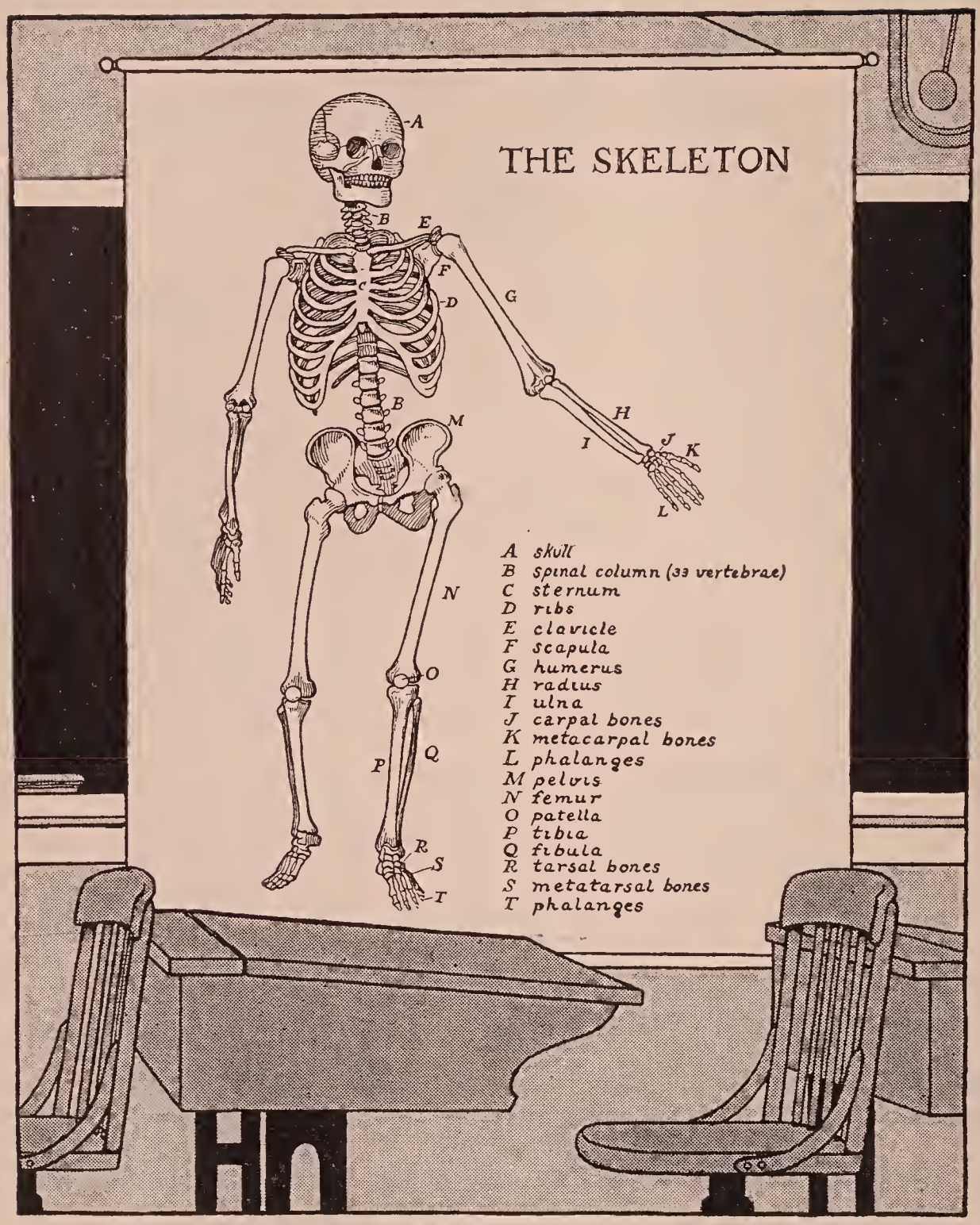
Red and white corpuscles of the blood (highly magnified)

The two kidneys are in the large body cavity at the small of the back and as the blood flows through them the *nitrogenous waste* is removed. Nitrogen is a substance which is found in all protoplasm; that is, in all living cells. It is the chief substance in protein. The tissues use protein foods for growth and repair, and their waste products are thrown into the blood and removed by the kidneys.

The importance of water.—Water also is thrown off by the body—through moisture in the breath as it comes from the lungs, through the kidneys, where it carries away nitrogenous waste with it, and through the skin, which is cleansed and cooled by perspiration.

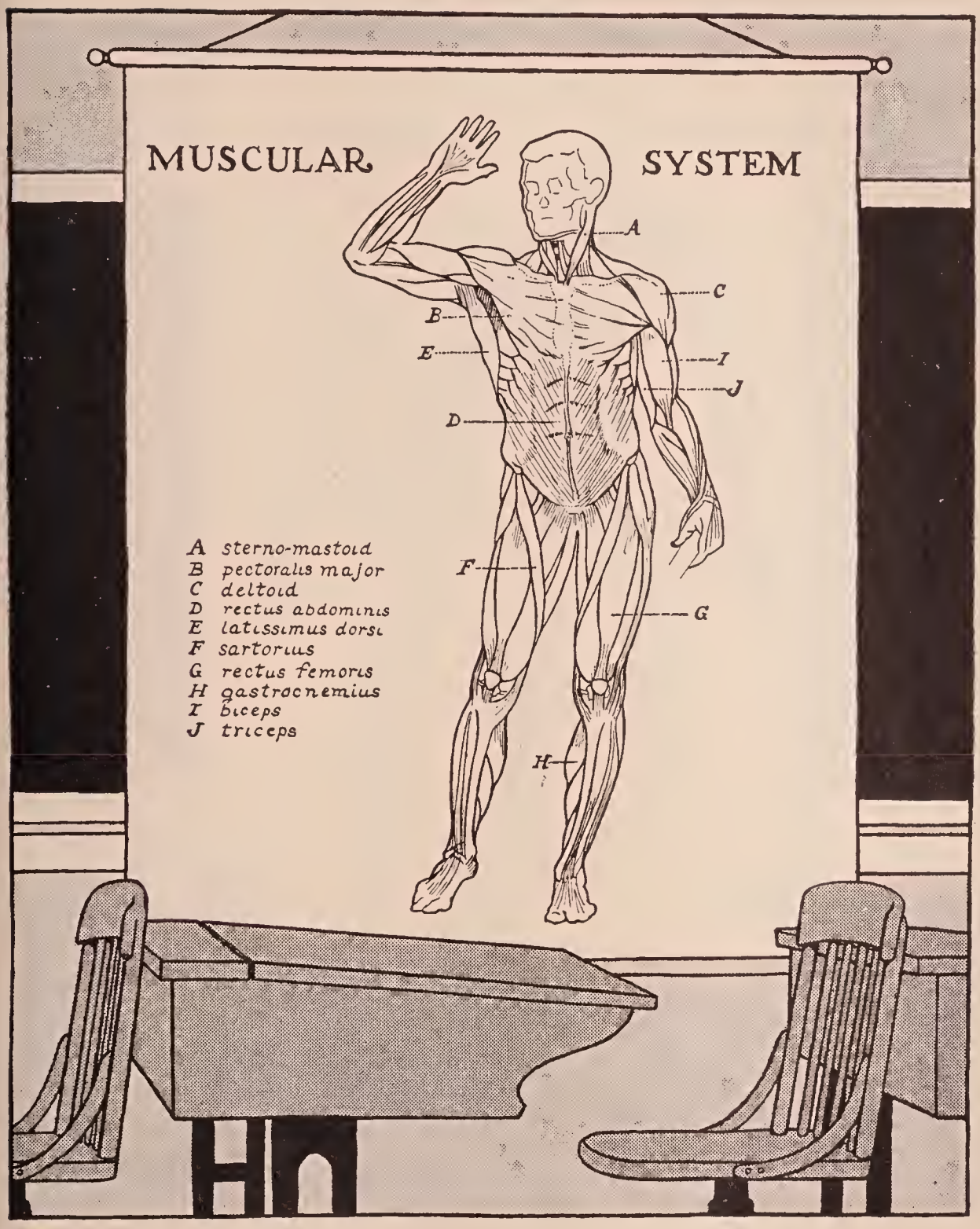
You can see several reasons for drinking a large amount of water. (1) The carrier system of the body is a water system. (2) The tissues are bathed in fluid. (3) The kidney uses water in removing nitrogenous waste. (4) The intestines need water to remove intestinal waste. (5) Water is needed for perspiration.

General body structures.—This chapter does not aim to describe the many structures of the body in detail, but merely to show what the units of body struc-

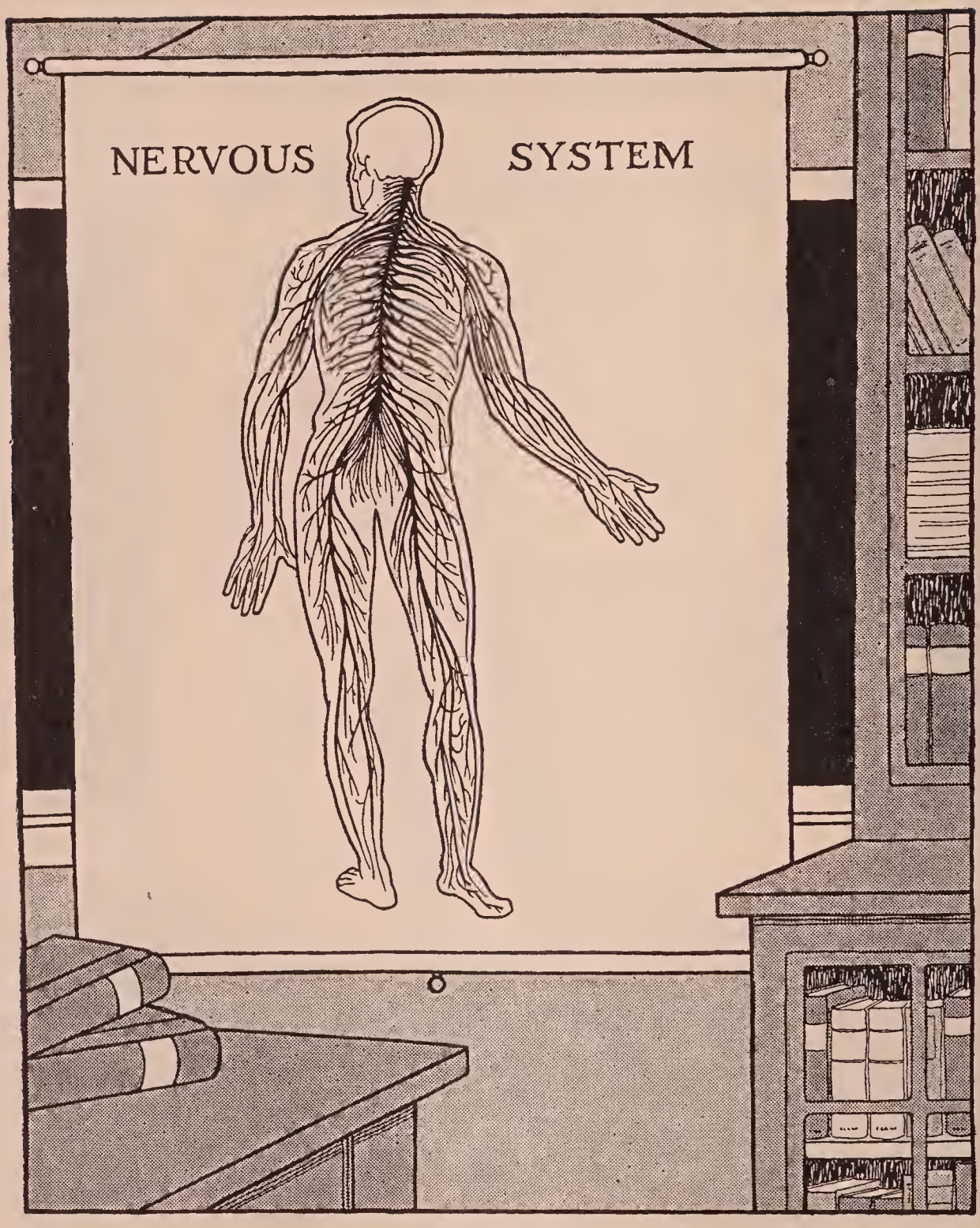


ture are and how these units—the cells—are supplied with food and relieved of their waste products.

In a general way you know most of the important structures of the body. The bones make up its frame-

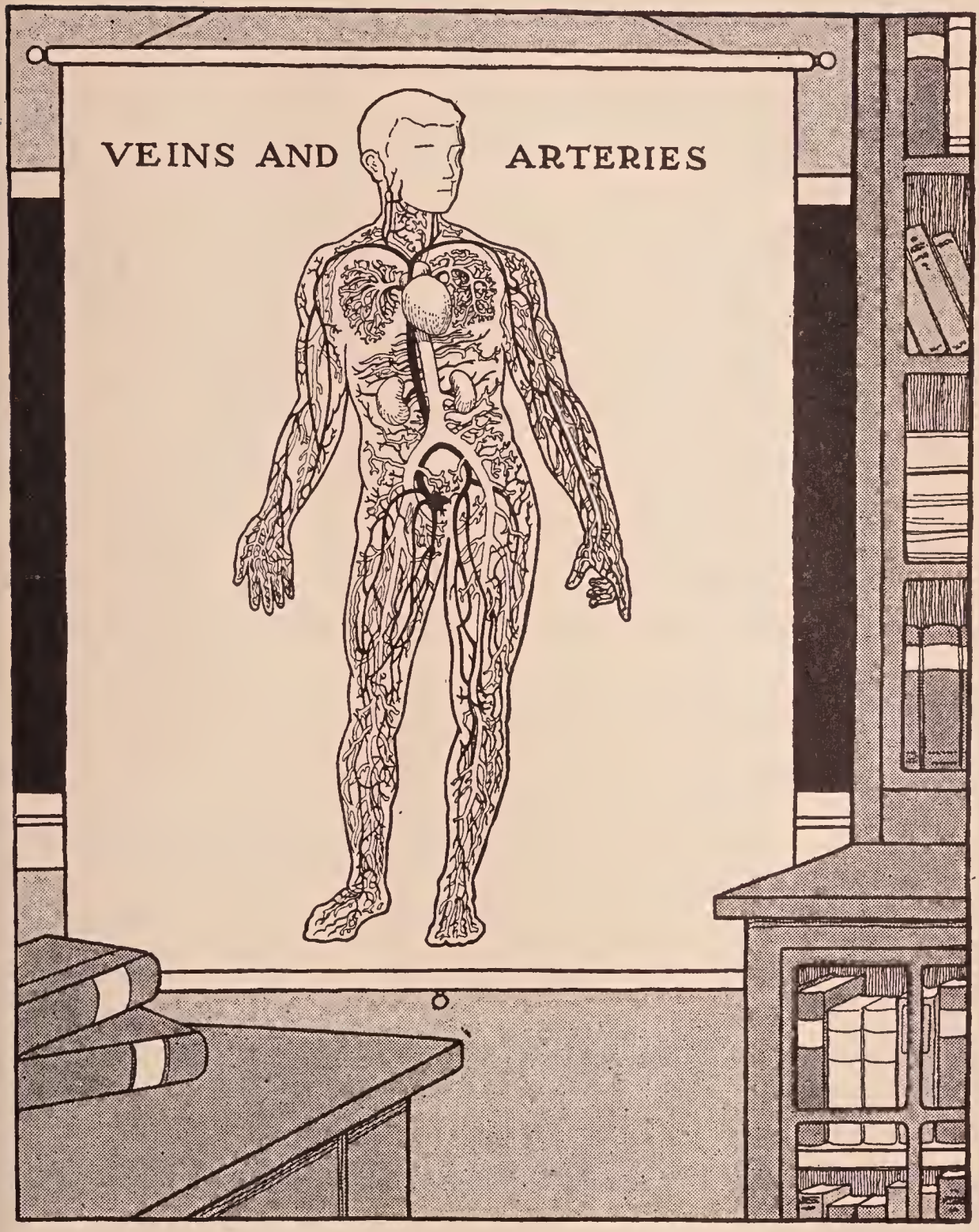


work, or skeleton. The muscles are attached to different bones and move them one upon the other, making possible all the various bodily movements. The brain and the spinal cord and nerves make up the



nervous system, which sends messages from any part of the body to the mind and from the mind to parts of the body.

The heart and blood vessels provide the carrier sys-



tem or the circulation for the body. The digestive tract furnishes the workshops in which foods are digested. The skin provides a protective covering.

Questions to Answer

1. What furnishes the power for the human body?
2. How is fuel burned in the body?
3. How does the body keep the same temperature all the time?
4. What is the building unit for the body? Name several different kinds.
5. What name is given to the living substance of the cell?
6. What is the difference between arteries and veins?
7. What is the work of the red blood corpuscles?
8. What is the work of the white blood corpuscles?
9. How is food carried to all parts of the body?
10. Name two kinds of waste from the body and tell how each is thrown off.
11. Give four reasons why the body needs a great amount of water.
12. What does the nervous system do?

Things You May Like to Do

1. Keep a record for two weeks showing the amount of water you drink daily.
2. Make a list of foods which contain a large amount of fuel for the body.
3. Make a list of foods which contain a large amount of building material for the body cells.
4. Count your pulse when you have been sitting still for some time; count the pulse again after you have been exercising vigorously. What is the pulse rate per minute in each case?
5. Refer to the chart on page 98 to see how many of the important bones of the body you already know by name.
6. Refer to the chart on page 99 to see how many of the muscles named you can locate on your own body.

X

WORKSHOPS OF THE BODY

When you think of "workshops," you think of places where men work to make things—perhaps furniture, pottery, or brassware. The chief business of workshops, as you know them, is to manufacture things or to make them over. There are strange and interesting workshops in the human body. Some of them are found in the digestive system, and the busy workers are the digestive juices. Here the foods are taken apart so that they can be used by the body.

The foods which you eat are used to build and regulate your body, and to furnish fuel, which is burned in the muscles to make you "go" and keep you warm. Your body cannot use these foods as they are, however. They must be separated into simple substances.

Imagine a lot of printer's type set up in "forms" which have been used. The type can be used again to set up new words, but it must be taken apart first. The different letters and figures must be separated from each other before they can be put together again in setting up new "copy."

The principle of digestion.—So it is with foods in the body. In the workshops of the digestive system the foods are taken apart. The simple substances are separated from each other. Then they can be absorbed

by the blood stream and carried to various parts of the body to be built into body tissues or to be burned as fuel.

You may remember that there are three groups of food substances: (1) proteins; (2) carbohydrates; (3) fats. (Name foods containing each.) Each food which we eat differs from the others in "composition"; that is, in the substances of which it is made. For this reason, all foods cannot be dissolved or digested by the same process. You can easily see that a digestive juice which would dissolve sugar might not affect fat at all. Indeed, water will dissolve sugar but it will not dissolve fat. You know also that certain cleaning fluids, used to remove grease spots from clothing, will dissolve fat but they will not dissolve meat or bread. In the workshops of the digestive tract, there are several different "workers," or kinds of digestive juices, so that each kind of food can be taken apart and changed into the simple substances which the body can use.

Digestion in the mouth.—The first workshop is the mouth. The teeth and jaws form a cutting and grinding machine which breaks up the food into small particles. Small glands, beneath and behind the lower jaw, pour out a digestive juice known as the *saliva.*

Saliva acts upon the starches, changing them into sugars. Chewing the food thoroughly gives an opportunity for it to become well mixed with the saliva so that the starches can be taken apart as completely as possible. The final work in digesting carbohydrates is done in the intestine. Thorough chewing also softens and moistens

all the food for swallowing and prepares it for the later processes of digestion.

From the mouth the food travels down a passage-way or tube to the next workshop, the stomach. The

food does not merely slide down; it is helped along by the contraction of rings of muscle in the wall of the tube. Have you sometimes felt this rhythmic contraction when you have accidentally swallowed a large, hard piece of food?

The work of the stomach.—The stomach is a pouch which not only carries on a part of the work of digestion, but also serves as a place for the immediate storage of a meal. The food enters at the large end of the pouch. The stomach is smaller at the opposite end where it joins the small intestine. At this end of the pouch there is a strong circular muscle which guards the exit from the stomach so that no food can pass out until it has been prepared to enter the next workshop. This place is called the *pylorus,* from the Greek word meaning "gate."

When the food first reaches the stomach, the digestion of starch by saliva is still going on; but this does not continue very long. The stomach secretes a juice of its own which contains an acid, and as soon as this mixes with the food the action of the saliva ceases.

The digestive juice which is formed in the stomach (gastric juice) is really made up of several different substances. Its chief work is to digest and dissolve the proteins. Lean meat and other proteins are taken apart or changed into simpler substances, which are dissolved and later pass through the walls of the intestine. They find their way to the blood and are car-

ried to the various parts of the body, where they are put together in different ways to make muscle and other tissues.

Toward the pyloric end of the stomach the muscular walls contract and relax continually when food is present. Thus the food is thoroughly mixed with the gastric juice, and when a small portion of food has reached the right point of digestion, the gate opens and lets it into the next workshop, the small intestine.

The small intestine.—The small intestine is the longest part of the digestive tract. It is twenty feet or more in length, coiled up in the region of the abdomen. There are three different workers here. The *pancreatic juice* flows into the intestine from the pancreas, a gland which lies just below the stomach. The *intestinal juice* is poured out from the walls of the intestine itself. The *bile* comes from the liver.

The pancreatic juice and the intestinal juice take the fats apart and complete the process of digestion for the carbohydrates and proteins. The bile is not an important worker in the process of "taking apart," but it appears to have a close relation to the absorption of fats by the blood.

The table on page 108 summarizes the process of digestion.

The work of the digestive juices in the intestine is helped by the action of the muscular walls. These contract and relax so that the food mass becomes thor-

Parts of Digestive Tube	Mechanical Processes	Digestive Fluids	Chemical Change
Mouth	*Cutting and Grinding*	*Saliva*	*Starch to Sugar*
Stomach	*Churning and Mixing*	*Gastric Juice*	*Protein to Peptone*
Small Intestine	*Mixing and Moving Food*	*Bile* *Pancreatic Juice* *Intestinal Juice*	*Carbohydrates to Simple Sugar* *Protein Digestion Completed* *Fats Made Ready for Use*
Large Intestine	*Food Forced on —Waste Expelled*		

oughly mixed with the intestinal juices and is brought into close contact with the absorbing surfaces of the intestines.

Absorption.—The lining of the small intestine is wonderfully planned for absorbing food. It is formed in little finger-shaped projections, called *villi.* These are richly supplied with tiny blood vessels, and their cells are especially adapted to the very delicate work of absorbing the various kinds of digested food substances. Here in the villi, these food substances are taken up either by the blood stream or by lymph vessels which empty into the blood stream.

Elimination.—Some parts of the food *cannot* be digested. This material is passed on to the *large intestine* or colon. The large intestine begins at the lower right-hand side of the abdominal cavity, passes up the right side, crosses the body just below the stomach, and passes down the left side. Its chief work is to absorb

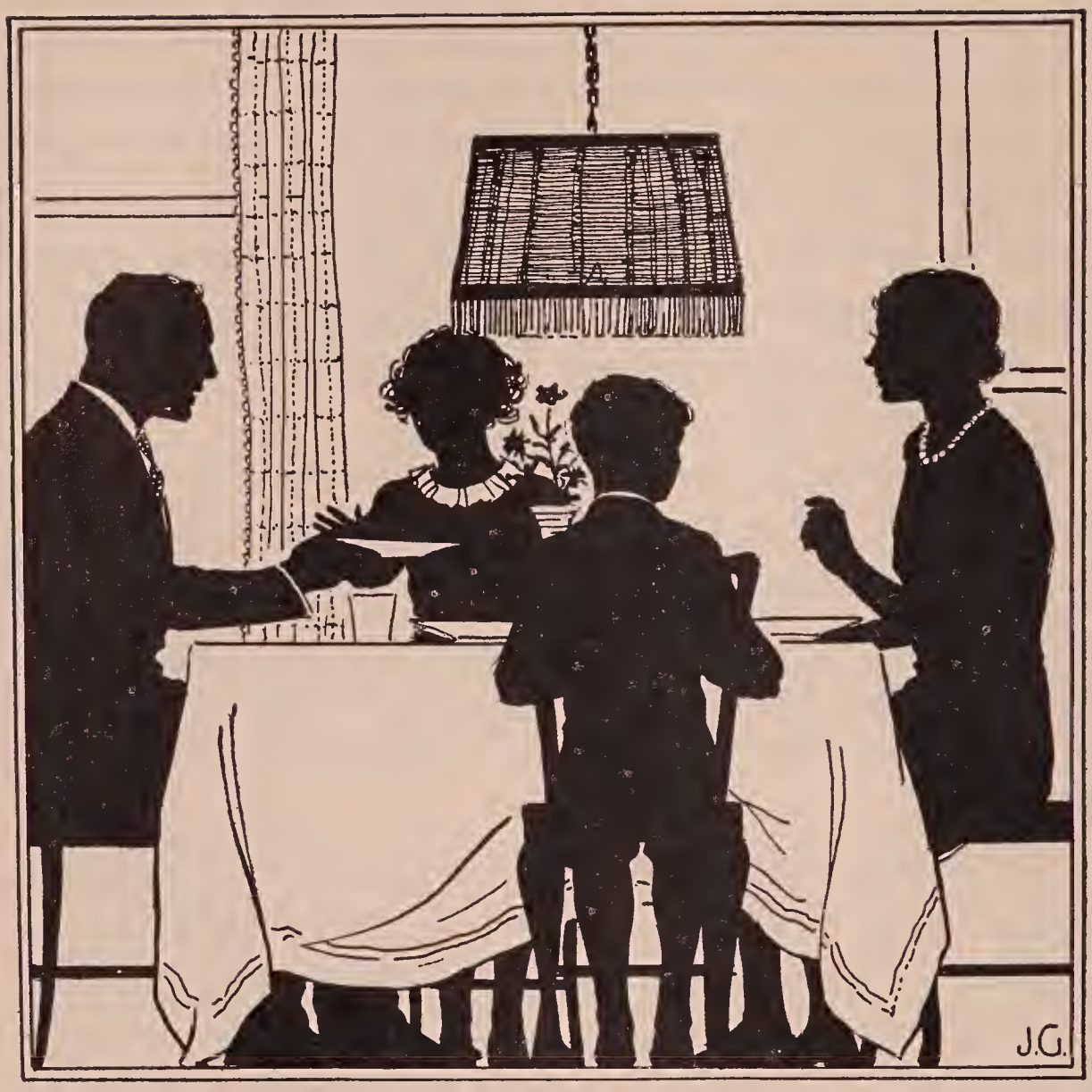
the surplus water from the remaining food mass, and to expel the waste substance from the body. This waste substance is partly cellulose, a material found in the fibers of fruits and vegetables and in the coarse outer parts of grains. Coarse material is valuable in the digestive system, because it furnishes the bulk which is necessary to stimulate the large intestine to expel the waste from the body every day.

Habits which aid digestion.—Understanding the simple facts about the parts of the digestive tract and the way in which the digestive process goes on will help you to consider in a new light the daily habits which are related to a good digestion. Here are some of the most important rules. Perhaps you can add others.

Eat three regular meals every day. The workshops of the digestive tract do better work on regular meals than on irregular ones. Most experts in nutrition advise the heavy meal at noon for children below high school age. If you have your heavy meal at night, be sure to have a good warm lunch at noon.

Eat a good breakfast every morning. In the morning you have been twelve hours or more without food, and your most vigorous work lies ahead of you. How can you be prepared for that work without a fresh supply of fuel for your body?

Eat slowly and chew your food thoroughly. This is the only way in which the workers of the mouth can do a good job. Here the starch should be



Have a happy mealtime.

changed to sugar, and the food mass prepared for the other workshops of the digestive tract. Take small bites.

Have a pleasant mealtime. Experiments with animals show that the flow of digestive fluids and the muscular contractions of the stomach and intestine are hindered, or even stopped entirely, by feelings of anger or fright. Quarreling or arguing over unpleasant sub-

jects at mealtime is not only impolite but also unhealthful. Children sometimes spoil a meal because of bad manners. Sitting properly and being polite at table is one way of helping every one in the family to have a pleasant mealtime. To be always cheerful and courteous is one of the best tonics for the digestive system. It is better to avoid eating when one is hurried or excited.

Avoid eating between meals, unless you really need extra nourishment. The complete process of digesting a meal requires several hours. If you make a practice of eating between meals, your digestive tract cannot have the proper amount of time for rest. You may *need* extra food, if you are thin, if you do not gain well, or if you have been ill. If you do lunch between meals, choose simple foods which will neither put a heavy strain upon your digestive tract nor spoil your appetite for regular meals. Milk, fruit, and bread and butter are the best between-meal foods.

Eat sweets only in small amounts and at the end of meals. Sweets spoil the appetite for other foods and do not contain the substances which the body needs for growth.

Avoid fried foods. When foods are fried, particles of carbohydrate or protein become encased in fat. Such particles are not easily digested because the juices in the mouth and stomach cannot dissolve the fat to get at them.

Have some vigorous exercise every day. Exercise

shakes up the digestive tract and helps to bring about a regular elimination of waste from the body.

Avoid alcohol and tobacco. Tobacco usually affects the appetite of a growing boy. Alcohol is injurious to the digestive tract.

Things You May Like to Do

1. Chew a piece of bread or cracker (starchy food) and see how sweet it becomes in the mouth as the saliva turns the starch into sugar.
2. Examine a piece of tripe, which is the carefully prepared wall of the cow's stomach. Notice the layers of muscle and the "honeycomb" surface on the inside.
3. Measure off twenty feet of string and see how far it reaches across the room. This gives you an idea of the length of the small intestine.
4. Use health-habit records to check up your habits related to digestion.
5. Use your influence in school to have only the right foods sold for lunch at noontime.
6. Plan several good menus for breakfast. Try to get every one in your class to eat a good breakfast every morning.

XI

KEEPING THE WORKSHOPS CLEAN

The workshops of the digestive system are truly wonderful in their ability to change the nature of food so that it can be absorbed by the blood stream. The food in the digestive tract does not come in contact with the body proper at all. It touches only the lining of the digestive system which you may think of as a kind of "inner skin," especially fitted to take from the food those substances which the body needs. This "inner skin" must be kept clean and healthy if it is to do its work properly.

Bacteria in the digestive tract.—It is important that only clean and wholesome food shall be taken into the digestive tract. You remember that harmless bacteria live in the mouth continually and in large numbers. They do not become extremely numerous in the stomach because of the acidity of the gastric juice. In the intestines, however, they find ideal conditions for growth. There is warmth, darkness, moisture, and a good supply of food.

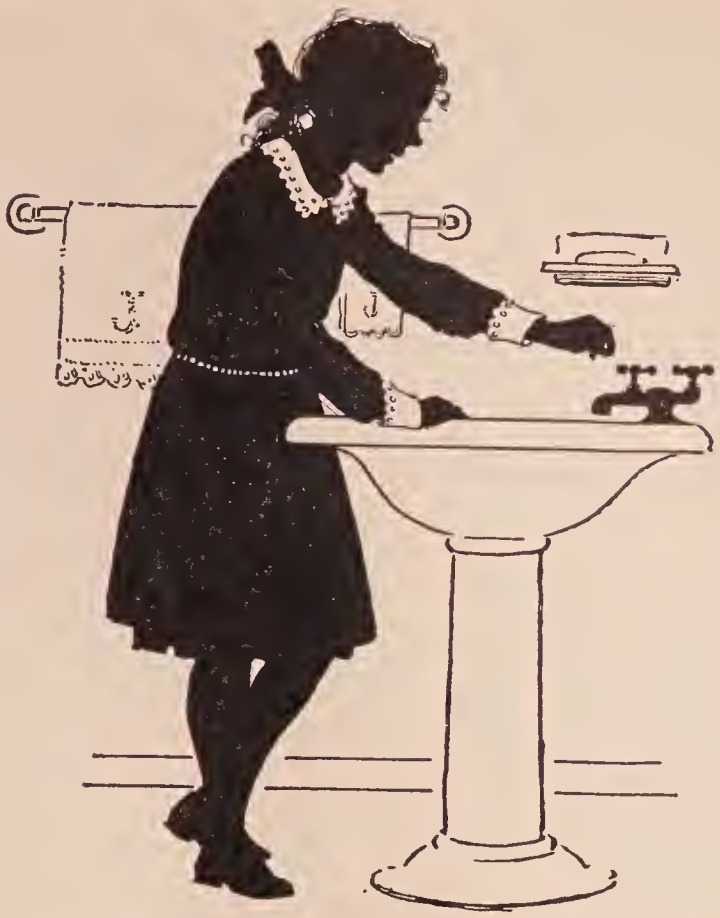
Most of the bacteria which grow in the intestine are harmless, but probably none of them are really useful. Dr. Metchnikoff long ago put forth the idea that the milk-souring bacillus is the least undesirable and that

Regulator foods

it reduces the number of the other bacteria. For this reason he advocated the drinking of sour milk.

Avoiding constipation.—Sometimes the food waste moves too slowly through the large intestine. This condition is called constipation. Bacteria act upon the contents of the intestine and produce undesirable substances. These substances, and the failure of the food waste to move on promptly, make one feel tired and nervous, or give one a headache. Indigestion and constipation often show in the complexion, causing "muddy" skin or pimples. It is essential, of course, to keep the *outer* skin clean, but surely the beauty and health of the outer skin reflect in no small measure the health and cleanliness of the "*inner* skin."

You can avoid constipation if you choose the right foods and eat properly. You need to have a proper amount of wholesome food, including plenty of fruits



Do you wash your hands before meals?

and vegetables whose fibers furnish "scrub brushes" to keep the intestine clean.

Drink large amounts of water every day, for water cleanses the "inner skin" as well as the outer skin. Cheerfulness and exercise keep the digestive tract ready to do its work. Thorough chewing helps digestion. If you follow these simple health habits, your digestion will usually take care of itself.

Typhoid fever.—In addition to the ordinary bacteria there are a few really harmful ones which can live in the intestines—poisonous plants which grow among the others in the digestive tract as poison ivy

grows among the trees and grasses. One of these is the typhoid fever bacillus.

When a few of these plants get into the intestine they find a favorable place for growth, increase rapidly, and produce poisons. The body absorbs some of the bacterial poisons, and a feeling of illness results. There is a battle between the man and the microbe. The typhoid germ makes a poison for man, and man straightway begins to make a substance which will kill the typhoid germ. Usually the man wins out, driving all the germs out of his body. Some of the anti-typhoid substances which he has manufactured for the body's defense remain afterward, and they protect him against having the disease again. When one is vaccinated against typhoid fever, some dead bacilli are injected under the skin, and the body goes through the same sort of process but with only slight discomfort. A person who has been vaccinated against typhoid will not catch the disease.

The typhoid fever bacilli, like all the other bacteria, are so small that they cannot be seen except with the highest powers of the microscope. When a person has the disease, the germs are thrown off from the body in the body wastes. If a few of these get into water or food and are swallowed by a well person, he comes down with the disease. In this way typhoid fever is spread.

Sometimes in the past a whole city has been in danger from typhoid fever because a public supply of

drinking water became infected by sewage which contained typhoid germs. Occasionally these bacteria get into milk from some careless person who has the disease. Flies may spread the typhoid bacilli. They walk about in the most filthy places. If they chance to pick up typhoid bacilli on their feet or legs, they are likely to leave them wherever they alight.

If you live in a town or city which has running water, your city government protects the purity of the water supply. If you have your own well in the country, it should be protected from dirt, and the toilet should be located so that no harmful substances may drain into the well. When on a vacation or camping, do not use water unless you have a good reason to believe that it is pure; that is, free from harmful bacteria. Water can be made safe for drinking by boiling for fifteen or twenty minutes. When camping be careful in the disposal of your body wastes, both for your own protection and for the sake of others.

Dysentery and cholera are other diseases of the digestive tract which are caused by harmful germs, and which may be spread from one person to another like typhoid. These diseases used to be very common, but now they are rare.

Rules for the cleanliness of the "inner skin."— There are two things, then, for you to consider in maintaining the health and cleanliness of the inner skin. First, take good care of your digestion so that the food will move along promptly. Second, be careful to avoid

filth of all kinds and to maintain the habits of cleanliness which will protect you from the few dangerous bacteria.

Here are some of the habits which are related especially to the *cleanliness* of the digestive tract.

Wash your hands with soap and warm water before meals and after going to the toilet. In this way you avoid passing harmful bacteria from the hands to the mouth.

Eat only clean food. Food which is exposed to dust and flies, or handled by dirty hands, is not clean. All foods which are ready to be eaten without further washing or cooking should always be kept covered.

Eat plenty of fruits, vegetables, and whole grains. These supply the *bulk* which is necessary to keep the food mass moving along through the intestines. This bulk also stimulates the daily elimination of waste. Coarse foods furnish the "scrub brushes" of the digestive tract.

Drink at least four glasses of water between meals every day. This helps to keep the digestive tract clean. It is well to drink the first glass before breakfast. Drinking water at meals is not harmful if you make a practice of never drinking when there is food in your mouth. Using water to wash down and soften the food *is* harmful, because water cannot take the place of saliva in the digestion of starch. Ice water may be injurious, if used in too large amounts, because it cools the stomach too much. Drink from an individual cup,

not a common cup. When using a drinking fountain, do not touch it with your lips.

Have a regular bowel movement every day. Go to the bathroom at a regular time, preferably after breakfast. The removal of body wastes is more important than the removal of ashes from a furnace.

Try to avoid taking physic. A laxative may be necessary occasionally when you are ill. If you get the habit of taking it often, however, it will interfere with the natural activity of the bowels. Chew your food thoroughly. Use nature's physics—fruits, vegetables, whole grains, water, and exercise. Have a regular time for elimination.

Questions for Discussion

1. What is constipation?
2. How is it avoided?
3. What is the cause of typhoid fever?
4. How is the disease spread?
5. How does cleanliness help you to avoid or "miss" typhoid fever?
6. What is the value of vaccination against typhoid fever?
7. What are the health rules which relate to the cleanliness of the "inner skin"?

XII

CLEANLINESS OF THE OUTER SKIN

Pinch the skin on the back of your hand and see how the small loose folds can be drawn away from the muscle and bone beneath. If you could see a section of this loose, thick skin under the microscope, you would find that it has two parts.

Epidermis.—The outer part, or *epidermis,* consists of many layers. The deepest layer is made of living cells which are continually growing and dividing crosswise. The older cells are constantly being pushed off toward the outside, forming the outer layers of the epidermis. Here the cells become flattened and are no longer alive.

This arrangement of the skin into layers is shown in the formation of a blister, which results from the separation of the outer layers of the epidermis from the inner layers, the space between being filled with clear fluid from the blood. The epidermis gives protection to the "true skin" underneath. The hair and nails are outgrowths of the skin. Although they grow from living cells, the outer ends are dead, like the outer layers of the epidermis itself.

The color in the skin comes from pigment which lies in the deep layers of the epidermis. In people of

Finger tip magnified to show pores

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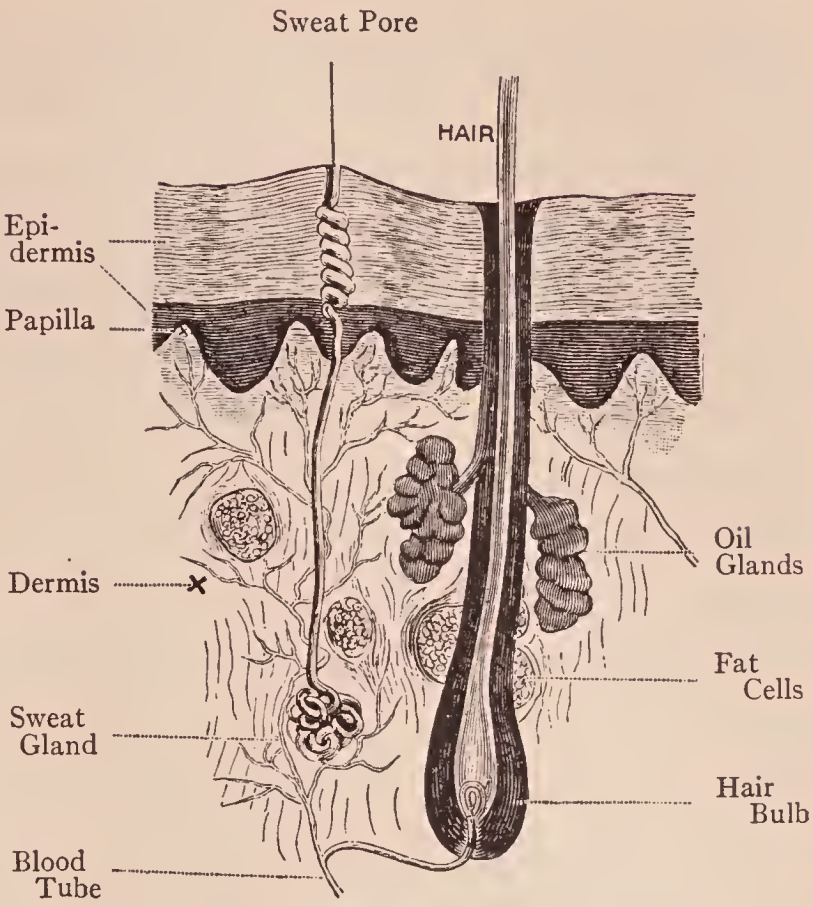
fair skin the pigment is small in amount; in those of dark skin it is more abundant. Freckles are caused by an irregular scattering of red pigment.

Dermis.—The *dermis,* or lower layer, is made up of a meshwork of connective tissue fibers, among which are found blood vessels, nerves, and groups of fat cells. Sweat glands, hair follicles, and oil glands belong to the epidermis, but they extend down into the dermis.

Pores.—Look at the skin on the palm of your hand, and you will find that it shows a series of fine lines. If you use a magnifying glass when the skin is perfectly clean, you can see on the sides of these lines very small openings called *pores.* These are the openings of the sweat glands, whose work is to pour out perspiration upon the skin. The evaporation of perspiration keeps the body cool. Perspiration or sweat contains some salty waste substances from the body. When the water evaporates, these substances are left as dirt on the skin.

Hair.—Examine the skin on the top of the forearm and notice that it is covered with tiny hairs. Hair is a typical part of skin structure. It grows most abundantly, of course, on the scalp. When the scalp is in good health, the hair looks smooth and glossy. This is due to the presence of oil from the little oil glands which grow at the root of the hair. The oily substance produced in these glands is poured out alongside the hair upon the skin, and it keeps the hair from becoming dry and brittle. It forms a part of the dirt which accumulates on the skin.

Circulation in the skin.—You have seen how the blood increases in the skin when a person blushes. On the other hand, when one is frightened, the skin may become very pale.



Vertical section of the skin

There are tiny blood vessels to be found in the inner part of the skin. The walls of these blood vessels contain muscles which can relax to make them larger, or contract to make them smaller. These muscles are controlled by a part of the nervous system, which increases or decreases the flow of blood in the skin automatically. When the skin is warmed, the blood vessels relax; when it is cooled, they contract.

Sense of touch.—What is the relation of the skin to the sense of touch? You *feel* through the skin, just as you *see* through the eyes and *hear* through the ears. How does this take place? Some of the nerves which come from the brain and spinal cord divide and subdivide into smaller branches until the tips of single nerve fibers end in the skin. Some of these nerve endings are

in the "touch corpuscles" which are pushed up against the epidermis in areas called *papillæ,* from which sensations of touch are sent to the brain. Other nerve endings pick up sensations of temperature or pain.

Fat cells.—Another element in the skin is the fat cell. You remember that the body has the ability to store up fat as a reserve supply of energy. Some fat is stored inside the body and some is stored in the dermis. If too much fat is deposited, the skin becomes loose and flabby. Just the right amount, however, gives smoothness and softness of line. It makes one better looking. This layer of fat also helps the body to save its heat supply. It is like an extra layer of clothing.

The skin is a living tissue. It regulates body heat, protects the structures underneath, and keeps us in contact with the outer world through the sense of touch.

A clean skin.—The most important thing for you to do in caring for the skin is to keep it clean. Dirt accumulates on the skin from the inside and from the outside. That from the outside may be soil, grease, paint, or just ordinary dust from the air. It is sure to be unsightly and it may have disagreeable odors. The bacteria contained in dirt are often dangerous from the standpoint of health. On the dirty skin they find a moist, warm place where they can keep alive. They die rather quickly on clean dry skin.

Most bacteria are harmless, as you know, but some produce boils or pimples. They grow down into the skin at the opening of a gland or around a hair shaft,

and produce an irritation with itching and smarting. The spread of catching diseases of the skin is prevented by personal cleanliness and by care in using one's own washcloths and towels.

Bacteria growing on the skin increase the undesirable odors of the waste substances poured out by the glands. A skin which is thoroughly clean has a fresh, pleasant smell, as you can notice from your own hands when they have been thoroughly washed with soap and warm water. A skin which is not kept clean develops a strong, sour, sweaty odor which is extremely unpleasant for other people.

In order to keep your skin really clean you need at least two warm baths a week, for only warm water and soap can remove oily deposits. Cold water cannot dissolve oily substances.

Clothing needs to be kept clean, too. Dirt from the skin soils the clothing so that it looks dirty and smells dirty. Stockings and underwear need particular attention. Underclothes should be removed at night and spread out on a chair or rack in the fresh air of your bedroom. Most of us cannot have a complete change of clothing every day. The next best thing is to air the clothing every night. Have clean underwear and stockings as often as you can. Changes need to be made more frequently in warm weather than in cold weather. Heavy clothing should be removed indoors so as to give proper ventilation to the skin.

Some parts of the body require special care as to

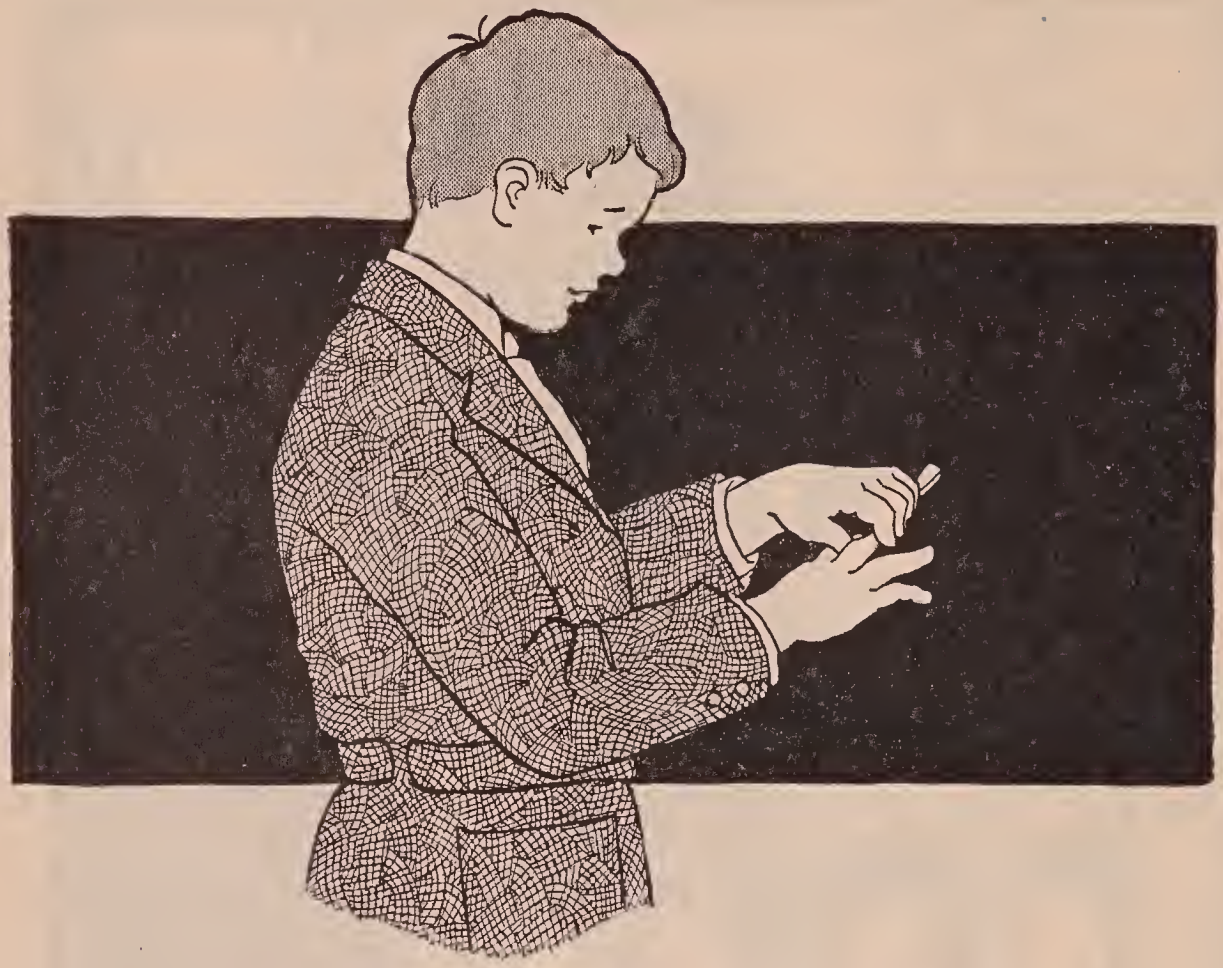
Take off heavy clothing indoors.

cleanliness. One perspires freely under the arms because cool air cannot reach this space. Disagreeable odors develop here unless one is particularly careful. The feet perspire, too, and if rubbers are not removed in the house, the amount of perspiration is increased. This not only produces unpleasant odor but it makes the skin tender. You know that wearing rubbers in the house is likely to cause chilblains in winter. The

Have you a just pride in your personal appearance?

feet sweat indoors, and when you go out in the cold air they become easily chilled.

The care of the hair and scalp.—The skin of the scalp also needs attention. Most girls like to have a shampoo at least once in two weeks. Boys can easily wash their hair once a week or oftener. When you shampoo your hair, give your scalp a good massage. This helps to increase the flow of blood in the scalp and



Will your finger nails stand inspection?

stimulates the oil glands, thus preventing the hair from becoming dry. Hair which is kept clean, combed regularly, and arranged neatly every day is likely to be glossy and attractive in appearance. Do not forget to keep the comb and brush clean, too.

After washing the head, dry your hair thoroughly either in the warm sunshine or in a warm room. If you go into cold air before the scalp is dry, the skin becomes chilled, and the scalp may even become sore and tender to the touch, like a lame muscle. Driving the blood away from the scalp in this way increases the conges-

tion of blood in the nose and throat so that one is likely to catch cold.

Clean hands.—Your hands come in contact with dirt more than any other part of the body, and for this reason they require more frequent washing. Because you use them for handling food, it is especially important to wash them thoroughly before eating, so that you will avoid carrying harmful bacteria into the mouth. Wash your hands after going to the toilet. Always rinse and dry the hands thoroughly to avoid chapping.

It is easy for dirt to accumulate under the nails. The boy or girl who wants to be really clean must take good care of them. Biting the nails is a very bad habit from the standpoint of cleanliness, because pieces of sharp nail, with dirt and bacteria attached, are taken into the mouth and may be passed on to the throat, where they scratch or puncture the soft tissues. Thus the throat may become infected with harmful bacteria.

There are other reasons, too, why children should not bite their nails. It makes the nails unsightly and keeps them so rough that cleanliness is almost impossible. It spoils the shape of the fingers, making them stubby. Nature meant finger tips to be tapering and sensitive. You cannot afford to spoil yours, for the hands you have now must serve you throughout life.

People are likely to judge you by the appearance of your hands. One likes to see clean nails, evenly filed, with smooth cuticle and fingers naturally shaped. The

appearance of your hands is as much a part of your individuality as the appearance of your face and figure. Do your hands add to your attractiveness or detract from it?

The complexion.—The skin of the face needs special attention, too, because it is exposed to dust constantly and to all kinds of weather conditions. It should be thoroughly cleansed every day with warm water and a good soap. It is important to find a pure soap which seems to suit your skin—one which cleanses the skin, making it look clear and clean, without irritating it or making it rough.

After being washed with soap and warm water the face should be well rinsed and given a final dash of cold water. Many people prefer to do the soap-and-warm-water washing before going to bed at night, and then use only cold water in the morning. Soap and warm water have a "drying" effect upon the skin because they remove the natural oil. Cold water is not particularly drying, and it invigorates the skin by stimulating the circulation.

The market is crowded today with countless aids to beauty. There is, of course, no beautifier which can produce the natural beauty of a healthy, well-cared-for skin. Good powders and cold creams do not injure the skin, though they are not necessary. Many of the much-advertised beauty aids, however, are really injurious to the skin. It is unfortunate that some girls, in their desire to add to their attractiveness, make them-

selves look as though they were wearing "false faces." Indeed, by their display of such bad taste, they lose the natural beauty and charm which they might otherwise have.

Cold baths.—The use of cold water on the skin is important, not only on the face but all over the body. A cold bath is partly for the purpose of cleanliness, but its chief value is to keep the skin healthy by making it accustomed to sudden changes in temperature. One might call it a method of "training" the skin.

You have seen how the amount of blood in the skin changes under different conditions. When a person goes outdoors in very cold weather, the skin becomes pale for an instant, but in a few minutes it becomes more ruddy than it was before. Every one knows that boys and girls who play outdoors in cold weather get rosy cheeks. This is because the body responds to the cooling of the skin by sending plenty of blood to keep it warm.

Cold water drives the blood away from the skin for a moment. Then the blood comes back in greater quantity than before, giving a warm glow which is very pleasant. It is better to start cold baths in the summer; then you can continue them all through the winter. You may have heard that cold baths "harden the skin" so that one does not catch cold. The skin of the person who takes cold baths does not actually become harder, but it becomes trained to adjust itself to sudden tempera-

ture changes. This helps one to avoid chills and makes him less likely to catch cold.

Vigorous boys and girls come to enjoy the cold bath and find it stimulating. A person who is chilled by a cold bath and whose skin does not react with a warm glow would better substitute a dash of cold water on the face, throat, and chest, or a vigorous rub with a rough towel every morning.

Injuries.—The skin is subject to constant small injuries. Try to avoid needless cuts, scratches, burns, and wounds. The skin protects the inner parts of the body. When bacteria enter a wound, they cause serious trouble. In a slight skin injury an immediate application of iodine will kill the bacteria which may be present. Deep wounds ought to be dressed by a physician.

A really beautiful skin is built from the inside out. No matter how careful a girl is in regard to outer cleanliness, she cannot hope to keep a lovely skin unless she also lives up to the health rules in regard to food, sleep, and exercise.

Examine your own skin with a critical eye. If it is clear, clean, and glowing with health, try to keep it always as attractive as it is now. If it does not reach the standard you want, what can you do to improve it?

Questions to Answer

1. What are the two parts of the skin?
2. What is the outer layer like?
3. What structures are found in the inner layer of the skin?

4. What is the special value of warm water and soap in cleansing the skin?
5. Why do cold baths help to keep one from catching cold?

Things You May Like to Do

1. Organize inspections if you have not done so already.
2. Help to train your younger brothers and sisters at home in habits of cleanliness.
3. Study the motion picture "The Skin" (Eastman Teaching Films) if it is available.

XIII

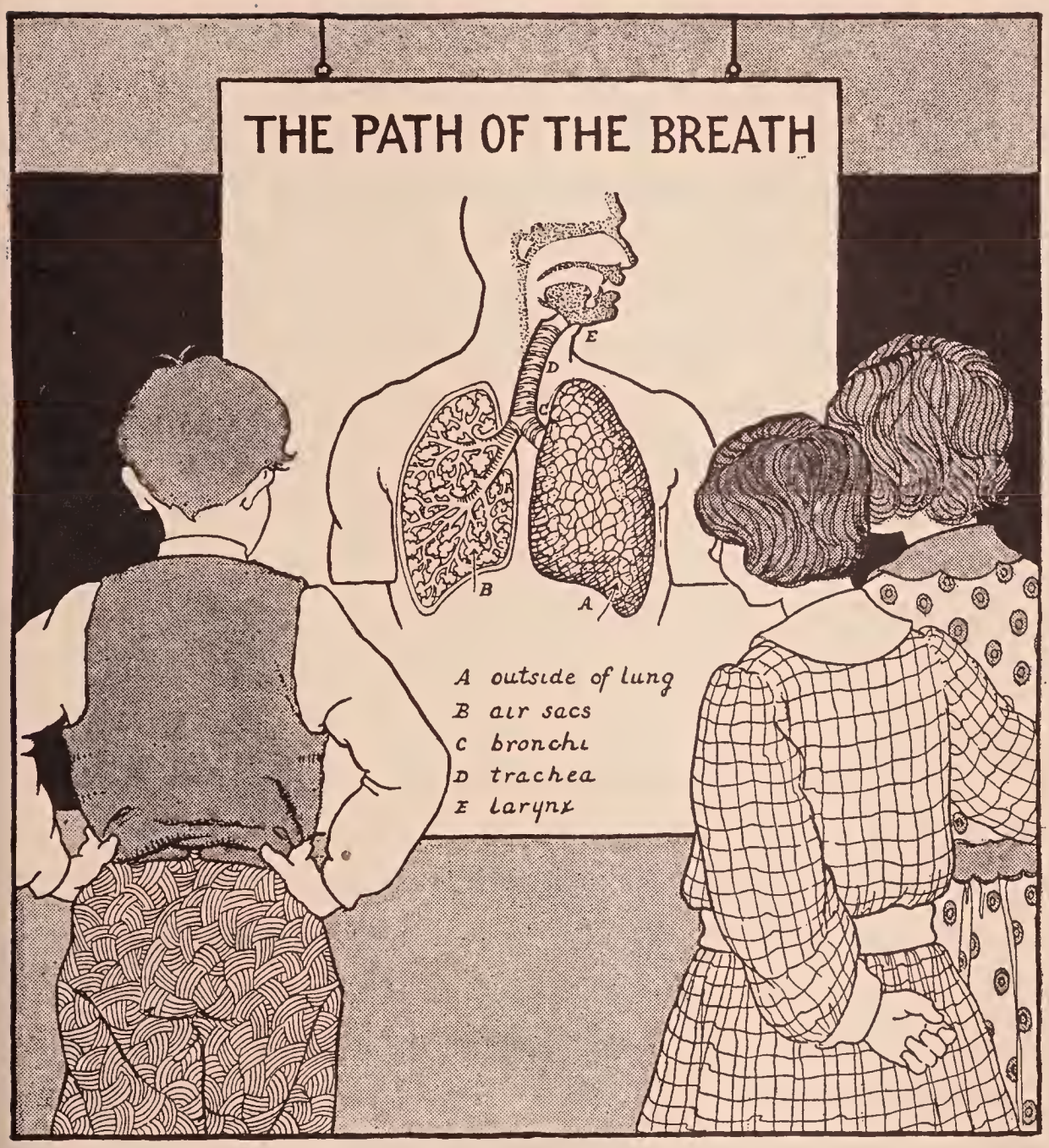
BREATHING STRUCTURES AND COMMON COLD

Breathing goes on so naturally and unconsciously that you think little about it, except when you are "out of breath" from hard playing. When you are exercising vigorously, you cannot help breathing faster and more deeply than when you are quiet. The usual rate of breathing is so constant in health that doctors use respiration as one of the signs by which they judge a patient's condition.

The use of oxygen.—A fire must have air in order to burn. If you fan it, it burns faster; if you keep the air away, you smother the fire and it goes out. This is because the process of burning uses up oxygen from the air. The body, too, needs oxygen in burning the fuel foods.

In order to take oxygen from the air, nature has developed special breathing structures. The whole air goes into the lungs; from it the blood takes out some of the oxygen and returns the waste gas, carbon dioxide.

Preparing the air for the lungs.—The air is warmed, moistened, and freed from dust by passing through the nose and throat. The upper parts of the nasal passages are subdivided, and open into small cavi-



ties, called sinuses. In this way, nature has provided a much greater surface inside the nose than would be thought possible, judging from the size of the nostrils.

The walls of the nasal passages are covered with mucous membrane, which is moist and richly supplied with blood vessels. The cells of this membrane have

tiny living processes, called *cilia,* which form a sort of "living velvet." The cilia are so small that they cannot be seen with the naked eye, but they are capable of a definite movement, which consists of a strong stroke in one direction, and a weaker one in return, somewhat like the rowing of a boat. The result is that anything lying upon the ciliated surface is moved along in one direction. You can easily see the importance of this ciliary motion in the nose. Dust and bacteria are caught and moved along with the mucus either toward the nostrils or toward the throat.

It is important to breathe through the nose so that the air may be warmed, moistened, and cleaned before entering the lungs. If you cannot breathe properly, it may be because you have some obstruction in the nose which ought to be removed.

The air passages of the throat and chest.—From the mouth or nose, the air passes through the throat, or *pharynx,* into the air passages leading to the lungs. The upper part of the air tube is known as the *larynx.* This is the voice box, which contains the vocal cords. These vibrate like violin strings when we speak or sing. An irritation of the larynx sometimes causes hoarseness or loss of the voice.

Below the larynx is the *trachea* or windpipe. At its lower end it forks into two branches, called the *bronchi.* One bronchus leads to the right lobes of the lung and the other to the left lobes. Both the trachea and the bronchi have firm walls with little rings of

cartilage which keep the tubes open. The bronchi subdivide into smaller tubes until they end in the little *air sacs* of the lungs. All these air tubes are lined with ciliated membranes, which tend to move dust and other irritating substances up toward the throat.

At the top of the air tube, above the larynx, there is a flap of tissue called the *epiglottis*. This opens to let the air in, or out, as you breathe and talk; it closes when you swallow food. Occasionally, if you laugh when you have food in your mouth, or try to talk and eat at the same time, your epiglottis does not work quickly, and you "get choked" by drawing food into the trachea. It is possible for this to happen because the paths of food and air cross in the throat.

The lungs and their work.—If you have ever watched the cleaning of a fowl, perhaps you have seen how light and spongy the lungs are in appearance. In structure they are somewhat like many clusters of grapes all coming from a common stem. The trachea is the main stem; the bronchi and its branches are the intermediate stems; and the individual air chambers represent the grapes. They are hollow, thin-walled pockets filled with air and supplied with an elaborate system of tiny blood vessels or capillaries.

As the blood flows through the capillaries in the lungs, the attraction of the red blood corpuscles for oxygen is so strong that the oxygen makes its way to the corpuscles, through the thin walls of the air sacs and the capillaries. At the same time the blood unloads most

of the carbon dioxide, which returns to the air in the lungs and is exhaled.

Breathing renews the air in these little air sacs where the exchange of oxygen and carbon dioxide takes place. Filling the lungs with air is somewhat like the process of blowing up water-wings. The wings are crumpled and crushed as you begin to blow. If you put in only a little air, the outer edges will still remain crushed; but if you fill them tightly, every crumpled spot is blown out smooth.

In ordinary breathing your lungs are not filled to their full capacity. When you exercise vigorously, your muscles call for a greater exchange of oxygen and carbon dioxide, so that you breathe more rapidly and with greater expansion of the chest. Thus, boys and girls who play vigorously every day develop good lungs.

Catching cold.—It is easy for bacteria to enter the air passages of the nose or throat, where they find conditions favorable for growth. Here it is warm, dark, and moist, and the body fluids furnish food.

It is important to keep the nasal passages clean. You should make a practice of carrying a clean handkerchief. A thorough cleansing upon retiring and upon getting up in the morning will keep the nostrils free from dust. Do not use too much force in blowing the nose, as this may injure the membranes or force fluid and bacteria from the nose or throat into the Eustachian tube, which runs from the back of the nasal passages to the middle ear.

Some of the germs which cause common cold may live in the air passages even when one is well. Moreover, there are so many different kinds, and they are so widely spread from the noses and throats of people having colds, that it is almost impossible for one to escape them entirely. They find their way into the respiratory tract, and await a chance to grow. When you are in a hot room, the membranes of the nose and throat are moist and red because of the large amount of blood flowing through them. Then, if you become chilled later, the blood is driven away from the membranes by the cold air. The membranes are still moist, however, and there the bacteria grow rapidly.

If you keep the body warm by exercise when you are outdoors in winter, you are not likely to catch cold. Wet clothing or wet shoes and stockings should always be removed as soon as possible. Protect yourself with warm wraps when you are overheated from vigorous exercise.

How do you feel when you have a cold? You may say that your "head is stuffed up," that your "nose runs," and that your "eyes water." Perhaps the throat is sore, too. If the cold is at all severe, the effect of the irritation in the nose and throat may extend to the whole body. There is slight fever, or headache, with a feeling of general fatigue and illness. Under such conditions an unusual supply of blood has been rushed to the mucous membranes of the nose and throat in an effort

to overcome the bacteria. A real battle is going on, and its heat is felt even in distant parts of the body.

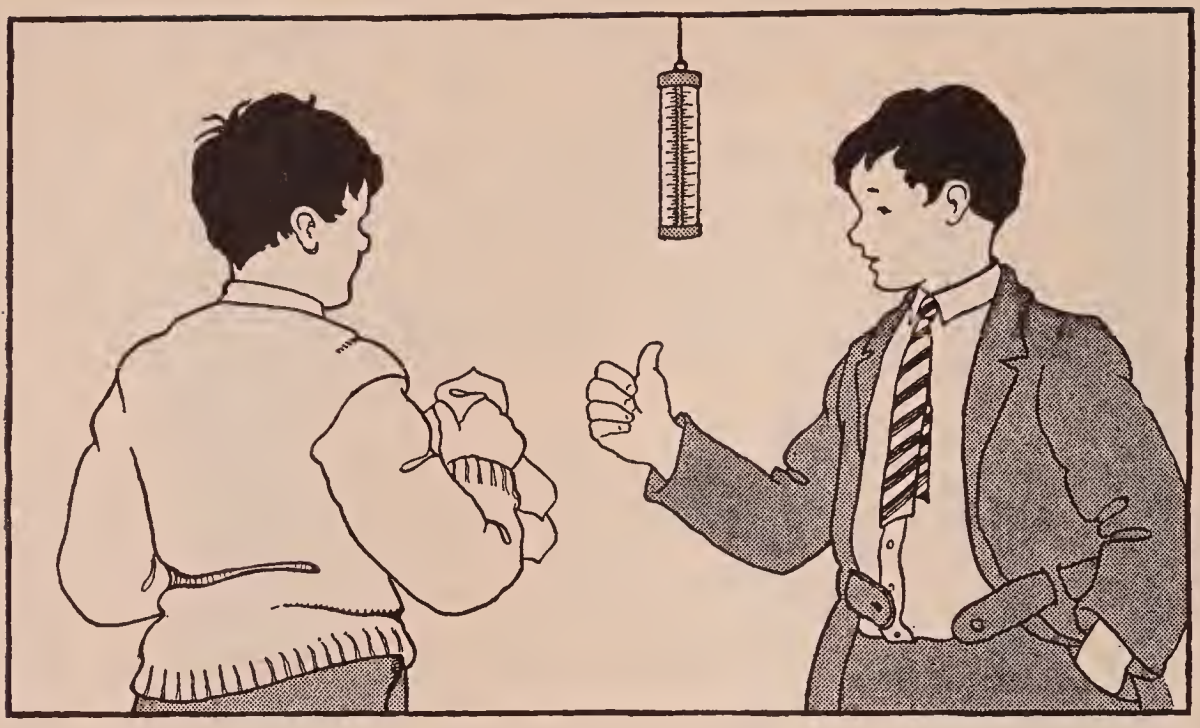
Avoiding colds.—How can you avoid catching cold? Keep yourself in *good health,* so that your body can resist vigorously the bacteria which cause colds. It has been proved that poor food, lack of sleep, and extreme fatigue make people more likely to catch cold. Physical defects, such as enlarged tonsils, diseased adenoids, and nasal obstructions, also favor colds.

Keep up the tone of your skin and mucous membranes by a *good circulation.* The circulation may be trained to quick *response* by the use of cold water every morning. The bath should be very brief, preferably with a shower, followed by a brisk rubbing with a rough towel, which helps to bring the blood back to the skin.

Some people who are frail and thin cannot afford to lose the amount of heat or energy which is taken from the body by a cold shower. These people may, however, use water which is *cool,* not really *cold.* If you cannot have a cold shower bath every morning, use cold water on the face, throat, and chest, or give the body a brisk rub with a rough towel without using any water. If you have plenty of outdoor play every day, and are not afraid of cold water and cold weather, you should have a circulation which is vigorous enough to save you from catching cold through an occasional change of temperature.

Live in *well-ventilated rooms* and have your *windows open at night.* Overheated rooms make one so sensitive to cold that the circulatory system cannot offset a sudden change in temperature. Rooms should be kept at a temperature of 68° to 70° Fahrenheit with moderate air movement. Spend part of every day in outdoor recreation, if possible, and avoid overcrowded and poorly ventilated places.

Be sensible about your *clothing* in cold weather. Take off coats, sweaters, and heavy wraps when you



Which boy is more likely to catch cold?

come indoors and put them on when you go out. If you keep them on all the time, you are too warm indoors and chilly outdoors. Take off rubbers and rubber boots in the house. When they are not taken off, the feet become wet with perspiration, and it is easy to catch cold.

Try to *avoid infection.* Keep away from people who have colds, and do not let any one sneeze or cough in your face.

Breathe through your nose, not through your mouth. The little hairs in the nostrils, and the ciliated surfaces of the nasal passages, are able to clean the air in a way which the mouth cannot do.

Keep your hands away from your nose and mouth so that you may not needlessly infect yourself with

bacteria which you have picked up in the constant handling of various objects. Avoid careless habits of putting pencils, pens, or money into your mouth.

Eat food which is clean, and wash your hands before eating. Exchanging bites of candy or fruit may mean exchanging bacteria, too. Drinking from a common drinking cup is another way in which bacteria are taken into the mouth. It is equally dangerous to drink from a bubbler which throws a stream so low that the mouth is put directly on the bubbler itself.

The bacteria of common cold are also passed about by the careless *exchange of towels or handkerchiefs.* If you are at all fastidious, the idea of exchanging such personal articles is unpleasant to you. If you are well informed in matters of scientific cleanliness, you know that such an exchange is dangerous.

Breaking up a cold.—If you feel yourself "coming down" with a cold, try to break it up in the very early stages. A hot tub bath helps to relieve the congestion by drawing the blood to the skin. If a tub bath is impossible, perhaps you can substitute a hot foot bath. In either case, be careful not to get chilled afterward. Have a hot lemonade or ginger tea, if you can, and get to bed promptly, covering yourself with plenty of bedding. A long night in sleep will give the cells of your body the best possible chance to overcome the bacteria. Drinking large amounts of water is an aid. A physic may help by cleaning out the digestive tract, and getting rid of body waste. If you are very ill, you will call a

Cover every cough and sneeze.

doctor, but at the first signs of a cold you want to do all you can to overcome it.

Taking care of a cold.—The next question is how to take care of a cold. If you cannot break it up in the way just described, you should stay in bed for a day or two. If you neglect to give your body favorable conditions for the fight, the attack of the bacteria is likely to be strengthened until you are quite ill. Some

other disease may follow the cold if you do not take good care of yourself.

When you have a cold, you owe it to others to give them the same protection which you would like them to give you. Your handkerchiefs and towels should be kept away from personal articles belonging to other members of the family. Wash them separately, boiling them and drying them in the sunlight. Cover your mouth and nose with your handkerchief whenever you sneeze or cough, for the bacteria of your cold are carried in the *droplets* from your nose and throat. Some schools do not permit children to be present when they have colds. Perhaps some day people will regard colds as they do other catching diseases, and put an end to them.

Questions for Discussion

1. What is breathing?
2. How does the body use oxygen?
3. What is the use of the ciliated surface in the air passages of the nose and throat?
4. Why should we breathe through the nose?
5. What should one do to take care of the nasal passages?
6. What is the value of the deep breathing which comes with exercise?
7. What causes one to "catch cold"?
8. What are the health habits which keep us from catching cold?
9. What are the simple things one can do to take care of himself when he first realizes that he is coming down with a cold?

XIV

CONQUERING TUBERCULOSIS

In the old days when knights rode forth on errands of helpfulness, and bold robbers prowled about the country, seeking fortunes and not caring whom they might destroy, there was little or no protection by law and police. "Let him save himself who can" might have been the motto. People who owned large estates with beautiful castles had to be able to defend them against any attack. They usually did this in two ways. First, they surrounded the castle with strong walls and a wide ditch. Second, they kept at the castle a force of men strong enough to withstand any attack which was likely to come. Thus, they did all they could to keep the enemy from ever entering their property, and they were prepared to lock him up in a dungeon if, by some trick, he succeeded in making entrance.

By a similar sort of fight we are conquering tuberculosis, a widespread disease, which is an old enemy of mankind. The tubercle bacillus has difficulty in entering the human body when protection is provided by habits of cleanliness in the individual, the home, and the community. Bacteria are so small and so easily spread, however, that this line of defense alone is not sufficient. Our chief protection comes from the ability

of the body cells to overcome the enemy who has been able to make an entrance. In the fight with the tuberculosis germ, vigorous health may be counted upon to win.

How the body imprisons the tubercle bacillus.—When the tubercle bacillus gets into the body, it usually chooses to live in the delicate tissues of the lungs. It locates itself in one of the terminal air sacs. Here the germ multiplies and produces a mild sort of poison. Immediately the warning goes out, and the body sets up a fight. The white cells of the blood rush to the spot, like the sturdy soldiers that they are. They surround the troublesome invader, the tubercle bacillus, and call to their aid the cells of the connective tissue. These cells build a tight wall about the bacilli and imprison them. This little ball-like prison, which the connective tissue cells have made, is called a *tubercle*. Hence the names *tubercle bacillus* and *tuberculosis*.

People who are in good health do not need to worry about contracting tuberculosis, because their bodies are able to carry on the "walling off" process so quickly. A few bacilli may have come to many of us without doing us injury. The cells of the body have imprisoned them without our knowing anything about it.

The importance of health habits.—Good health habits enable the body to protect itself. You know that when people do not have the right kind of food, or enough of it, they become thin. Moreover, the cells of the body are not nourished as they should be, and

they lack the ability to respond quickly to a call for help. You do not find it easy to do a heavy piece of work or play a vigorous game when you are faint from lack of food. Neither can the body cells rally to your defense when they are poorly nourished. An example of this has been seen in some of the countries of Europe where children were so poorly fed during the war. In those countries there was a marked increase in the amount of tuberculosis.

A proper amount of sleep and rest is as important as proper food. When the body becomes fatigued from overwork or from lack of sleep and rest, the general health is affected. Here again the vitality of the body cells is lowered. They are not fit for vigorous activity any more than you are fit for active work and play when you are very tired.

Fresh outdoor air and sunshine appear to be very closely related to the fight of the body against tuberculosis. Dr. Edward Trudeau performed experiments with rabbits, which showed this relation in a very interesting way. He inoculated certain rabbits with the tubercle bacilli and kept them in a dark, damp place without sunlight and fresh air. Other rabbits were inoculated in the same way and allowed to run loose in the open. Those shut in the dark came down with tuberculosis, while those living in the open recovered. When people learn to open their windows at night, ventilate their houses well in the daytime, let in the sunlight, and live as much as possible in the great outdoors, a

long step will be taken toward the conquering of tuberculosis.

The use of alcohol lowers body resistance. When a person takes enough alcohol at one time, he becomes "drunk," or unconscious, almost like a person who has taken ether. You can understand that any substance which has such a powerful influence upon the body must have a definite effect upon the body cells. Apparently the cells which imprison the tubercle bacillus are among those which are weakened or partly put to sleep, for it is certain that people who use alcohol are more likely to develop tuberculosis than those who do not. Doctors are very strict in forbidding the use of alcohol by tubercular patients.

The importance of cleanliness.—Keeping good health is the first safeguard. The second precaution is through those habits of cleanliness which will prevent the bacilli from entering the body. It is hard to be sure that you *entirely* avoid coming in contact with the tubercle bacilli, even though your general habits of cleanliness are good. You can avoid, however, coming in *direct* contact with the disease. The bacilli are given off in the sputum of people who have tuberculosis, and it is likely to be carried in *droplets* of sputum from the nose or throat in sneezing or coughing.

A well-bred person knows that coughing in another person's face is poor etiquette and poor hygiene. If some people are neither well-bred nor well-informed enough to be careful in such matters, you will do well

to avoid them. In no case should you allow any one to cough or sneeze directly into your face. A careless cougher does not necessarily have tuberculosis, but the fact that he has a cough indicates that there is some cause of irritation from which other people should be protected.

In caring for a case of tuberculosis, nurses take every precaution not to infect themselves. Things used by the patient are used by no one else. *Everything* coming in contact with the sputum is either thoroughly sterilized or burned. Those who wait upon a patient are especially careful about the cleanliness of their hands, in order to avoid carrying infection from hands to mouth. Tubercle bacilli can get into the body by being swallowed as well as by being drawn into the air passages in breathing.

Preventing tuberculosis.—Some of the lower animals are subject to tuberculosis. The germ which attacks the cow is not exactly like the human tubercle bacillus, although it can grow in the human body. It is called the *bovine* type of bacillus, the word "bovine" coming from the Latin word "boves," meaning *cattle*. The bacillus of bovine tuberculosis may be carried to people through the milk of cows infected with the disease, and it often causes tuberculosis of the glands in the neck. For this reason, the milk supplies which are considered safest are those coming from cows which are regularly tested and found free from tuberculosis. Another way to safeguard the milk supply is to pasteurize

Sunlight helps to conquer tuberculosis.

the milk. In this process the milk is heated enough to kill any tubercle bacilli if they are present.

With increased knowledge about tuberculosis we are really conquering the disease. Since 1900 the death rate in the United States has been cut in half. Surely we may hope for another big reduction within the next generation!

Tuberculosis can be arrested.—Years ago people felt quite hopeless if they found that they had tuberculosis. Now the outlook is very favorable *if the disease is discovered in the early stages.* This is one reason why people should go to their doctors for regular yearly physical examinations. "Have a physical examination on your birthday" is the slogan. In such an examination, the existence of tuberculosis can be

discovered before the disease is far advanced, and its development can be stopped within a few months by proper treatment. Once the disease has established itself, a great deal of lung tissue may be destroyed; then the cure is not so easy.

A sanitarium is one of the best places in which to be treated for tuberculosis. The things which are done for the patient there are just those simple, everyday things which enable the body to make a fight against the disease. The patient has plenty of fresh air, sunlight, and good food, including milk, eggs, fresh fruits, and vegetables. Long hours of sleep and rest in the open air do their part to help restore him to health and strength.

Some people have the mistaken idea that tuberculosis comes from *weak* lungs, and that a patient should build strong lungs by deep breathing and exercise. Exercise, with its natural accompaniment of deep breathing, is an excellent thing for a healthy person, but it is altogether wrong for a person who has once developed tuberculosis. In vigorous exercise the air cells of the lungs are filled so tightly that the partly healed spots may break open. Then the tubercle bacilli escape from their prison before the prison walls are completed.

The same methods that are used in the sanitarium can be used at home if patients will follow the doctor's directions exactly. One difficulty in treating a patient at home is that he is likely to be less regular and careful in his habits than he would be at the sanitarium. An-

other difficulty is that proper precautions may not be taken to protect the other members of the family. A person who has tuberculosis should want to safeguard other people from the disease, and those who come in contact with the patient should insist upon such safeguards.

Doctors, health departments, and tuberculosis associations are leading the fight against tuberculosis. What is *your* share? You can protect yourself by building up a strong, healthy body. You can spread, by your example and influence, the gospel of clean habits. You can coöperate with the Tuberculosis Association by the purchase of Christmas Seals and by helping your local Association whenever there is an opportunity.

Things You May Like to Do

1. Discuss the health habits which aid in the battle against tuberculosis.
2. Make a list of the ways in which we can prevent the spread of tuberculosis.
3. Discuss the things which are done for a person sick with tuberculosis to help him get well.
4. Look up the places and organizations in your community which are combating tuberculosis in some way.
5. Study the moving picture "Tuberculosis and How It May Be Avoided" (Eastman Teaching Films) if it is available.

XV

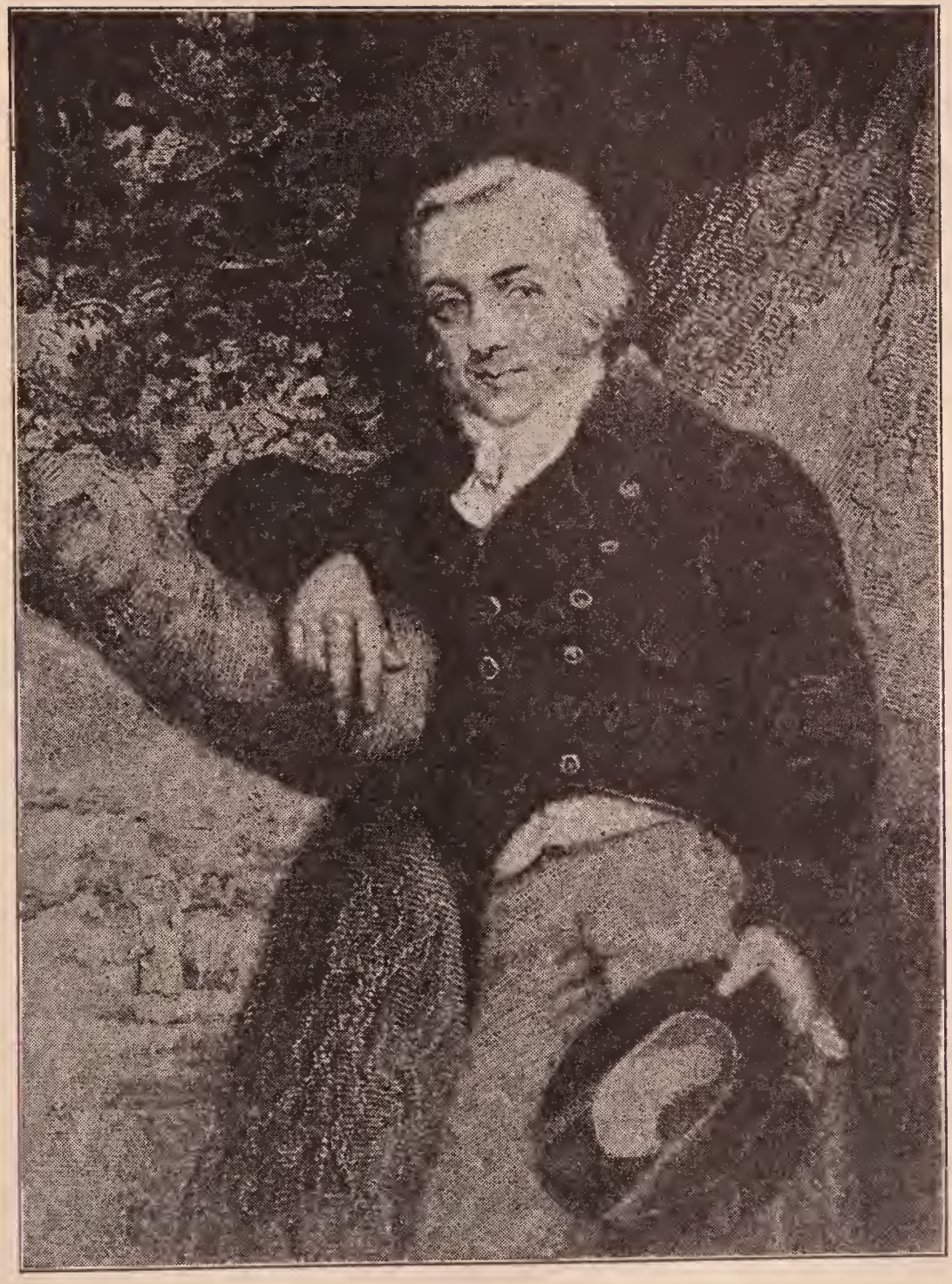
THE SCIENCE OF PREVENTION

Cleanliness offers us a large measure of protection from those few bacteria which are injurious. A further defense exists in the ability of the body itself to fight and conquer the harmful bacteria which find their way in. You have seen how the body defends itself from tuberculosis by the action of body cells. In tuberculosis and in common cold you have examples of the way in which general vitality and good health give protection from disease.

Protection by chemical substances.—There is another kind of protection which the body is able to develop; namely, a defense by the manufacture of chemical substances. Such a protection is possible against smallpox, typhoid fever, diphtheria, and other diseases. In these diseases, vigorous health alone does not give protection.

You have heard of chemical warfare which is carried on by the use of poisonous substances, one army sending out poison gas over the trenches of the enemy. The men who are being attacked put on masks which allow them to breathe through a filter containing a chemical substance which offsets the poison.

The battle between man and most of the harmful



Edward Jenner

bacteria is largely a chemical warfare. The bacteria produce substances which are poisonous to the body. The body in turn produces substances which offset the poisons of the bacteria. Usually the body cells conquer, the bacteria are killed, and the body is freed from them.

Even the greatest scientists do not understand the exact nature of the chemical substances, the particular cells of the body which produce them, or the exact manner in which they are produced. We do understand the general principles, however, and we know enough about the process so that we can protect ourselves. Many diseases which were formerly looked upon as dangerous enemies of man have been nearly conquered by modern science.

The story of smallpox vaccination.—The first and perhaps the most interesting source of our knowledge came in conquering smallpox through the use of vaccination. You rarely hear of this disease today, but it was once more common than measles, and it has always been a much more dangerous disease. The skin "breaks out," leaving deep scars or pits which remain throughout life.

It is hard to realize that five hundred years ago almost every one's face was pitted by smallpox, and that more people died from smallpox than from any other disease. Such was the case, however. It was a children's disease, for not one person in a thousand grew up without having had it. One was so sure to have it that in Asia there developed the custom of infecting

children purposely with smallpox. In this way a convenient time for having the disease might be chosen and the child be given the best possible care.

To infect a child in this way, a bit of material from the skin sore of a person having smallpox was transferred to the skin or nostrils of the child. This practice was known as inoculation. It spread throughout the Old World, and even made its way to America.

At first, it appeared to have many advantages. Children were infected from the skin of those who had mild cases, and so the disease was usually milder and less dangerous. People became careless in regard to inoculation, however, so that epidemics often spread from inoculated people, and it became an unsatisfactory way of controlling the disease.

A disease called *cowpox* had been known for a long time. (This is really smallpox in the cow.) This disease of the cows often caused little sores on the hands of milkers if there happened to be a cut, scratch, or break in the skin of the hand. It was observed that milkmen and milkmaids who had developed cowpox sores on their hands were among the few people who escaped smallpox.

In 1744, a farmer who had observed this, purposely infected his children with cowpox by introducing some of the matter from the sores of the cow into their arms with a darning needle. He did not make his experiment known, however, and it was Edward Jenner, who,

some time later, applied the principle to the control of smallpox.

Edward Jenner was born at Berkeley in Gloucestershire, England, more than a hundred and fifty years ago. He was a healthy boy who loved the outdoors and was especially interested in natural history. When he was about eight years old, he went through the trying experience of inoculation for smallpox, being ill for about six weeks. Little did the small boy realize that some day he was going to bring an end to the unsatisfactory method of inoculation, and replace it with the simple process of vaccination!

At the age of thirteen Edward decided to become a doctor, and was apprenticed to a firm of surgeons with whom he stayed for six years. While he was there a country woman came to him one day for medical advice. He was deeply impressed by a statement which she made in regard to smallpox. "I cannot take it," she said, "for I have had cowpox." This fact was known among farmers and country people, you see, for some time before any one thought of using the principle for the control of smallpox.

After his apprenticeship with the firm of surgeons, Jenner became a pupil of the great anatomist, Hunter, in London. Here his training continued, and his interest in the study of smallpox increased. Hunter encouraged this interest, and in 1780 Jenner began definite studies. He spent years in collecting descriptions of cases where people had contracted cowpox and after-

Have you been vaccinated?

ward had been able to resist smallpox. It was not until 1796 that he put his theories to the test.

Cowpox broke out on a farm near Jenner's home, and a dairymaid became infected with the disease. Some of the poisonous matter was taken from a sore on her hand and put into the skin on the arm of a small boy named James Phipps. About a week later, James was slightly ill and there was a small sore on the arm; but it passed away quickly, and the arm healed. Only a few months later, Jenner inoculated the boy with matter taken from a smallpox patient. James did not develop smallpox. The inoculation with smallpox was

tried a second time some months later, and again the boy was proof against the disease. Vaccination was successful. (Vaccination comes from the Latin word "vacca," meaning *cow.*)

Imagine the satisfaction and joy in Jenner's heart when he found that the dreams and studies of long, long years were about to be realized in such a great blessing to the world! The use of vaccination spread rapidly throughout Europe, and it was first introduced into America in 1800. Vaccine is now made very carefully and distributed to doctors by health departments. Vaccination has been made simple and safe; it protects you from all danger of smallpox.

Ever since the days when Jenner first experimented with vaccination, there have always been people raising objections to it. Now, when smallpox has been so largely reduced by vaccination that most of us have never seen the horror of the disease, there is a dangerous tendency to stop vaccinating.

In the Philippines we have had a marked example of the serious results when vaccination laws are relaxed. Before the United States took over the Philippines there were thousands of deaths every year from smallpox. Under our government, vaccination was compulsory, and smallpox almost disappeared. Then in 1913 the health organization was turned over to the Filipinos, who did not enforce vaccination.

Five years later came a great epidemic of smallpox,

with fifty thousand deaths. Over five thousand American troops were stationed there, but they had been vaccinated, and out of that number only one man contracted the disease. Vaccination was their defense. As a result of the epidemic with its frightful loss of life, vaccination was reëstablished in the islands, and smallpox again disappeared.

Smallpox is conquered only so long as we keep up our wall of defense by vaccination. Health is no insurance against this disease. Protection lies only in the development of chemical substances in the body which offset the infecting organism. Have *you* been vaccinated?

The principle of protection against smallpox by vaccination is now quite clear, even though we cannot see the organism which causes the disease. It seems that the germ has been weakened and changed by living in the body of the cow so that it grows but feebly in the skin of the arm where it is introduced. It cannot produce typical smallpox; but it does produce smallpox poisons which cause the body to manufacture anti-poisons. The anti-poisons not only kill the cowpox germs and help the scratch of the skin to heal, but they also accumulate and remain in the blood. These anti-poisons promptly kill any smallpox germs which get into the body for several years to come.

During Jenner's time people did not understand this explanation because no one had heard of germs caus-

ing disease. They knew only that cowpox—a disease limited to a temporary sore in one spot of the skin—was a sure preventive against smallpox.

Pasteur discovers the principle of protection.—It was Pasteur who first saw the explanation. You remember how he discovered that bacteria cause the "diseases" of beer and wine and the disease of silkworms. He thought that bacteria might be the cause of the "catching" diseases in man, and he was the first to suggest the idea of a disease as a battle between man and a germ. He concluded that in vaccination man always wins the battle because the smallpox germ has been weakened by living in the body of the cow. Straightway he set about testing this theory by weakening the germs of other diseases so that protective "vaccination" could be tried.

At about this time it was proved that anthrax, a disease of sheep and cattle, is caused by bacteria. Pasteur grew the anthrax bacilli under such unfavorable conditions that they were barely able to keep alive. He injected these weakened germs under the skin of healthy cattle and sheep. The process of overcoming these weakened enemies was so easy that the animals showed no sign of the disease. In this way, however, the animal body gained the ability to overcome even the strongest and most vigorous of the anthrax germs. An animal "vaccinated" against anthrax cannot have the disease; it has been made immune.

The Pasteur treatment for preventing rabies or

hydrophobia in man is based upon this same principle. These early discoveries of Pasteur have led to the development of a new science—preventive medicine.

Vaccination against typhoid fever.—Have you heard of the process of vaccination against typhoid fever? In this case the bacteria which cause the disease are grown in a test tube upon specially prepared culture media. They are removed from the test tube, killed with heat, and then injected under the skin. The body easily produces the anti-poison and thereby gains the ability to protect itself from living germs of the disease.

The control of diphtheria.—One of the best-known applications of preventive medicine is its use in the prevention and cure of diphtheria. Have you heard of diphtheria antitoxin, or of the Schick Test? Let us find out what science has to tell us about them.

Diphtheria is caused by the diphtheria bacillus, growing in the throat or nose, and often producing a grayish patch on the side of the throat. Some of these bacteria can be taken from the throat of a patient, transferred to a test tube containing suitable culture media, and grown in the laboratory.

As these bacteria grow, they secrete or discharge from themselves a powerful poison which is called diphtheria toxin. When they are growing in the nose or throat, this poison is absorbed by the fluids of the body and carried about by the blood. It is the diph-

theria toxin which produces the serious effects of the disease.

You know that a person who has had diphtheria once is not likely to have it again. This is because the body has developed an anti-poison—diphtheria antitoxin. Antitoxin is nature's remedy for the disease.

Science has found a way to develop this substance in the blood of the horse. Small quantities of diphtheria poison are injected under the skin. The horse may be a little uncomfortable, but he is carefully taken care of, kindly treated, and he looks sleek and contented with life. He manufactures antitoxin in his body just as human beings do when they have diphtheria. After a few weeks some blood is removed from the horse, and the antitoxin is taken out.

Antitoxin is a sure cure if it is used the day the disease starts, and it will usually effect a cure if used at a later period. The more prompt the treatment, however, the more certain is the cure.

You may have heard how, only a few years ago, the city of Nome, Alaska, was saved from a diphtheria epidemic. The nearest supply of antitoxin was nearly a thousand miles away, with no means of transportation except dog teams, which would usually take about fourteen days for the trip. Fourteen days was too long! In that time diphtheria would have done its worst! But the worst did not happen, for over the frozen tundra, through the bitter Arctic cold, brave men and dogs raced as they had never raced before, and in

Photo by Hiram Meyers. Courtesy of Milbank Memorial Fund.

Immunization against diphtheria saves thousands of lives. The spot of iodine on the baby's arm shows where toxoid or toxin-antitoxin is injected.

five and a half days the precious antitoxin was delivered to the anxious doctor in Nome.

Antitoxin, taken from the horse and injected into the body, is thrown off with the body discharges, and when it is gone, there is no longer any protection against diphtheria. When the body produces *its own* antitoxin from having had the disease, the protection seems to be permanent.

A process has now been discovered by which one can be permanently protected from diphtheria through using a mixture of toxin and antitoxin. When these two substances are mixed together, the toxin does not injure the body, and yet it causes the body to produce its own antitoxin so that a permanent protection is secured. Toxoid (toxin which has been made harmless by the addition of a chemical) is used for the same purpose.

A simple test, called the Schick Test, has been devised to tell whether or not a person is immune to diphtheria; that is, whether he already has antitoxin in his blood. A little test solution is introduced into the outer skin of the forearm. This is a painless process because there are no nerve endings in the outer skin. If a person already has antitoxin in the blood, the test solution is promptly neutralized. If he has no antitoxin, there is enough irritation to produce a little red spot on the skin. This is spoken of as a positive reaction, and is a sign that a person should be treated with toxin-antitoxin in order to be made immune.

Babies should be immunized between the ages of six months and one year. When all boys and girls are protected by toxin-antitoxin before entering school, diphtheria among school children will disappear.

Scarlet fever can be controlled to some extent in a similar way. We do not have such good weapons against some of the other diseases, such as measles and chicken pox. Fortunately for us, *nature* has discovered the weapons, and when the germs get into our bodies, nature will promptly produce the substances necessary to kill them and bring the body back to health again.

Remember, then, that in some diseases, like tuberculosis and common cold, general bodily health is the best protection. In other diseases, like smallpox, diphtheria, scarlet fever, and typhoid, protection depends upon having the right anti-poisons in the blood; that is, upon vaccination or immunization.

Questions for Discussion

1. What is the difference between the way the body protects itself from tuberculosis and the way it protects itself from smallpox?
2. How important was smallpox five hundred years ago?
3. What was inoculation against smallpox?
4. What is cowpox?
5. What is vaccination?
6. How did Jenner discover vaccination?
7. How did the experience of the Philippine Islands show the value of vaccination?
8. Why does vaccination protect against smallpox?

9. What was Pasteur's idea of the way in which we could protect ourselves against such diseases?
10. How did Pasteur protect animals against anthrax?
11. What is vaccination against typhoid fever?
12. What is diphtheria toxin?
13. What is diphtheria antitoxin? Its use?
14. What is diphtheria toxin-antitoxin? Its use?
15. What is the Schick Test?

Things You May Like to Do

1. Find out whether every one in your class has been vaccinated against smallpox and immunized against diphtheria.
2. Study the film "Diphtheria" (Eastman Teaching Films) if it is available.

XVI

HARMFUL SUBSTANCES

The human machine, like any delicate mechanism, needs to be protected from contact with substances which may harm it. Probably you already know something about the way in which alcohol, drugs, and tobacco affect the body. Now that you have learned about bacteria and the way in which the body protects itself against disease, you can understand some additional facts about the effect of these substances upon the human machine.

Alcohol.—Alcohol is one of the substances thrown off from yeast plants when they are growing in sugar solution. In making wine, the juice of grapes is pressed out and poured into great vats. Yeast cells are allowed to grow in these vats of sweet grape juice. In a few days the nature of the grape juice is completely changed. The yeast cells have used up the sugar and have thrown off alcohol as a waste product until so much alcohol is present that the yeast cells cannot live in the fluid any longer. A similar process is used in making beer. In this case, however, the liquid is made by soaking the sugar out of sprouting barley seeds.

Wine and beer contain less alcohol than distilled liquors, such as whisky and gin. The process of distilling concentrates the alcohol; that is, there is a greater

amount of alcohol in any given amount of liquid. There is a limit to the amount of alcohol produced by the growth of yeast cells, because the yeast plants begin to die off when the liquor contains about ten per cent alcohol.

In order to secure the stronger liquors, therefore, the process of distillation must be used. This is done by boiling. Alcohol boils at a temperature lower than that necessary for boiling water. When a liquid containing alcohol is heated, the alcohol turns to vapor before the water boils at all, so that the first vapor which passes off is alcohol. This vapor can be collected, and thus the concentrated, or distilled, liquors are made.

Whisky is made by distilling fermented corn or rye. Brandy is made of distilled wine. Rum comes from distilled fermented molasses. Gin is secured from a fermented mixture of rye and malt. These distilled liquors usually contain from thirty to sixty per cent alcohol. Wine contains only from seven to twenty per cent alcohol, and malt liquors, like beer and ale, contain from three to eight per cent. Sometimes the alcoholic content of wine is increased by adding alcohol.

Alcohol, as you may know, belongs to the group of substances called narcotics. A narcotic has a peculiar effect upon the brain. In fact, one might say that it puts the brain cells to sleep. When a person drinks alcoholic liquors, the brain is gradually affected by this "sleep-producing" action of the narcotic. If a person drinks enough, the sleeping effect is so complete that

unconsciousness results. Even in small amounts, the effect upon the brain cells is so marked that memory is injured and the mind is unable to do quick or accurate work.

Some of the injurious effects of alcohol.—Some interesting tests were made in a college some time ago to measure the effect of alcohol upon ability to do mental work. Students were required to add up columns of figures, and were checked as to the time used in making the additions and as to the number of mistakes made. After the first trial, they were given a small amount of alcoholic liquor and then required to perform the test again. They were so confused by the drink that they felt sure they had made a better record than at the first trial. When the results were checked up, however, they found that not only had it taken them a longer time to make the additions, but that they had made more mistakes.

Interesting experiments with typesetters have been reported. The men were setting up type from an author's manuscript. Even moderate doses of alcohol reduced the amount of work they could do and increased the number of mistakes they made.

Such effects in the nervous system show up very quickly under the influence of alcohol. Other more serious effects often appear when alcohol is used continuously in large amounts. Parts of the brain are seriously injured, resulting in certain forms of insanity. The records of some of our insane hospitals show that

Alcohol is forbidden to athletes in training.

twelve per cent of the people admitted for mental disease have suffered the results of alcoholism. There is no doubt that abstinence from the use of alcoholic liquors is an important step toward reducing the amount of mental disease.

Alcohol affects the body, too. It reduces the ability of the muscles. Scientists find from experiment that at first the activity of muscle is slightly increased, but

that very soon it becomes weaker than normal. The end result is that the muscle loses in ability to do work. Heart muscles work faster under the influence of alcohol, but the heartbeat is weaker.

Alcohol and the death rate.—You can easily see that anything which produces such a marked effect upon mind, muscles, and heart must reduce the general health and vigor of the body. The figures gathered by life insurance companies show that people who use alcohol do not live so long as those who abstain. A man who drinks heavily is not considered a "good risk" for insurance.

A very interesting study along this line was made from the records of forty-three life insurance companies.* A large number of insured men were divided into four groups, and the death rates were compared. The division of groups and the comparative death rates were as follows:

Group I included just average people insured by the companies, without regard to whether they used alcohol or not. The death rates for the other groups were compared with the death rate for this group.

Group II included people who, when insured, were moderate drinkers, using perhaps two glasses of beer or a glass of whisky every day. In this group, the death rate was eighteen per cent higher than in the first group, representing an average.

* From Report of Medico-Actuarial Mortality Investigation, IV, pages 11–13.

Group III included those who admitted having at some time used alcohol immoderately, but who were believed to be cured of its use. The death rate among these people was fifty per cent higher than the rate for the average in Group I.

Group IV was made up of men who drank more heavily than those in Group II, but were looked upon as fairly healthy. The death rate here was eighty-six per cent more than the average death rate in Group I.

Of course the increased death rate among the groups which used alcohol was probably not entirely due to the effect of the alcohol. No doubt people who avoid alcohol take better care of their bodies in other ways, too. Whatever the reasons for longer life, certainly one would be fortunate to belong to that class of people who care enough for health to preserve it in every possible way.

One reason for increased death rate among alcoholics is that alcohol interferes with the ability of the body to fight disease. You know how the white blood cells imprison the tubercle bacilli which get into the lungs. They do a similar work in many other diseases. In

* These are comparative rates—not specific annual death rates.

some kinds of infection, however, the protection of the body does not lie so much in these "soldier cells" as in certain chemical substances which are produced somehow in the body and given into the blood stream. The effectiveness of the defense is reduced by alcohol. Certain protective substances appear to be actually destroyed by alcohol, although we do not know exactly what takes place within the body. People who use alcohol freely have almost no ability to fight off pneumonia. They also have little resistance against tuberculosis.

Arctic explorers have long known that the use of alcohol is dangerous to men who must be exposed to severe cold. It causes the blood vessels near the skin to dilate and fill with blood, thus increasing the loss of heat from the body. Such a loss may prove fatal to men in the Far North whose lives depend upon keeping a sufficient amount of body heat.

A story is told of woodmen who were obliged to spend a cold night away from camp. Those who drank whisky felt comfortable and soon went to sleep. The others were uncomfortable all night, but were alive in the morning, whereas those who drank whisky were frozen to death.

We can summarize the harmful effects of alcohol as follows: (1) It injures the brain and nervous system so that ability to do mental work is decreased. If used freely, it may produce mental disease or certain types of insanity. (2) It interferes with the muscular system,

thereby reducing the amount of physical work or athletic ability. (3) It makes the heartbeat more rapid and less strong. It interferes with the circulation, causing the body to lose heat more rapidly. (4) It reduces the power of the body to protect itself against disease.

In 1918 the Prohibition Law went into effect in the United States, through a Constitutional Amendment proposed by Congress and approved by two-thirds of the states. The law was established because people felt that alcohol was a decided evil in destroying health, happiness, and prosperity. Some people who did not want the law passed insist upon getting liquor in spite of national prohibition. Out of this a new danger has arisen. Wood alcohol and other poisonous substitutes are used to manufacture drinks. They also affect the body seriously. Many people have been made blind by such liquors, and in some instances sudden death has resulted.

Drugs.—There are many drugs which are "habit-forming" and which affect the body in a way similar to alcohol; these include opium, morphine, cocaine, heroin, and chloral. These substances are perhaps even more dangerous than alcohol. When a person has formed the habit of using them, he finds it almost impossible to live without them. His body feels so wretched without the drug that he is willing to do almost anything to get more. He loses not only his health but his self-control and self-respect as well.

It seems strange, perhaps, that people who know the

danger involved should begin the use of these drugs. Sometimes they take drugs first in patent medicines without realizing that anything unusual is happening until the drug habit is formed. The danger from patent medicines was so great that national laws have been passed to control the sale of drug-containing medicines. The Pure Food and Drug Act requires that patent medicines shall be correctly labeled, and the Harrison Narcotic Law definitely restricts the sale or use of the habit-forming drugs.

It is really dangerous to use patent medicines of which you know nothing except that they are advertised to cure this, that, or the other disease. A few simple home remedies may be used in cases of slight illness, but when you are sick enough to need "medicine" you need to call your doctor.

Some of these drugs are very useful in the hands of a skilled physician as a means of reducing pain for people who are ill and suffering. These dangerous drugs cannot be purchased unless prescribed by a doctor.

Tobacco.—Tobacco belongs to a group of plants which includes not only the useful potato and tomato, but also such poisonous plants as the "Deadly Nightshade" and "Henbane." It contains the narcotic substance, nicotine, the harmful effects of which appear in many ways.

College athletes are not allowed to smoke while they are training. One reason is that tobacco affects the heart, frequently causing it to "skip" beats.

Tobacco plant

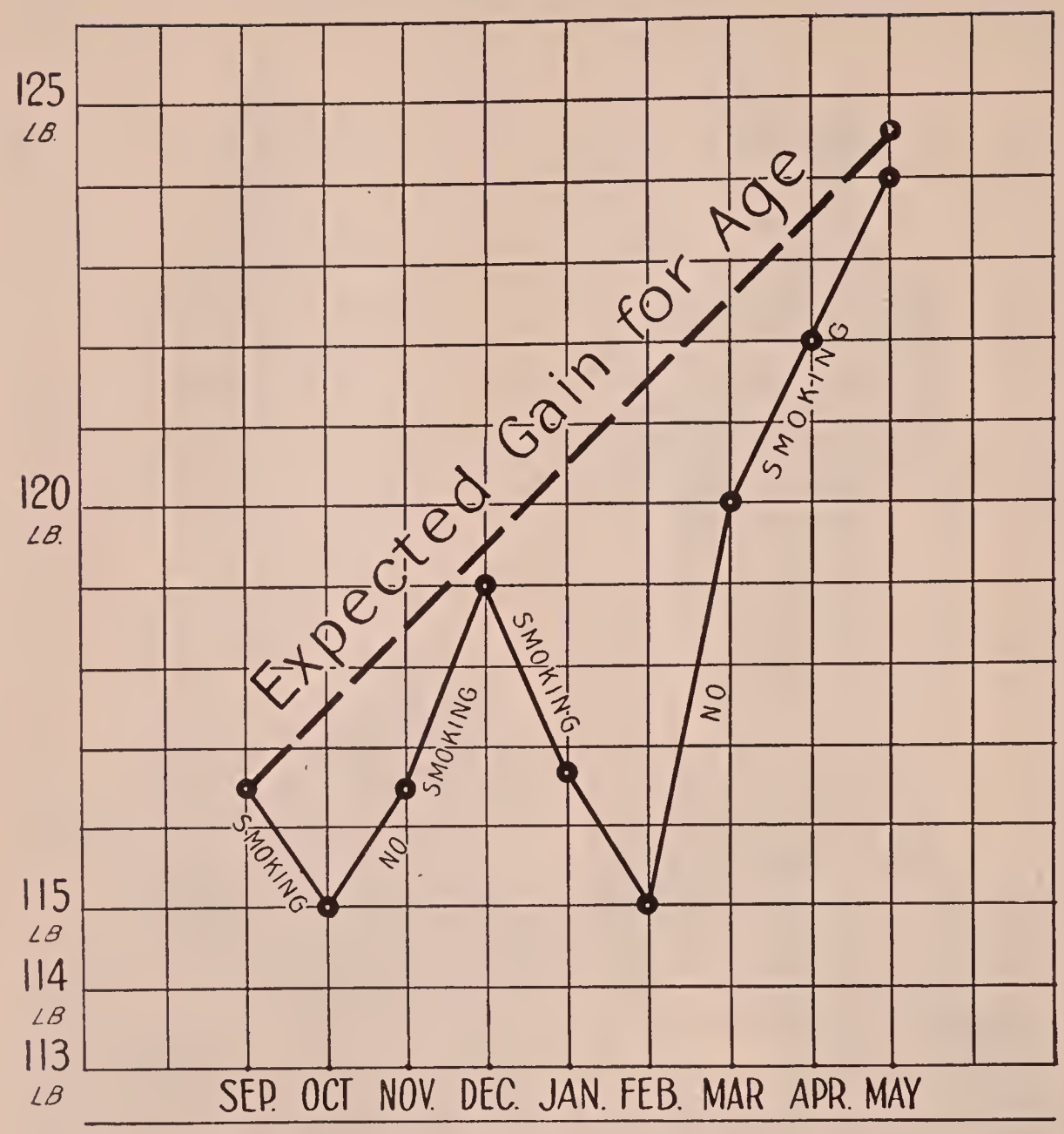
Another reason is that it interferes with the efficiency of the nervous system. This is shown in an interesting way by experiments made with rifle marksmanship. The marksmanship of the men was improved by resting, provided they did not smoke during the rest period. If they did smoke while resting, their accuracy was decreased. The more they smoked during the rest time, the more their accuracy suffered.

The effect of tobacco upon the nerves is at first mildly exciting. After a little while, however, the effect is one of deadening or depressing the nervous system. Some doctors say that they have found eyesight injured by continued and heavy smoking.

Professor Irving Fisher of Yale University has the following to say about tobacco: It injures the heart. It disturbs the blood pressure. It poisons the nerves. It hurts the eyes. It lessens the resistance to tuberculosis and other diseases. Its use sometimes produces cancer. It often leads to the use of alcohol. It re-

Testing rifle marksmanship

duces much of the power and accuracy of the mind. It impairs working efficiency. It decreases athletic power. It stunts the growth of the young. It probably shortens life.



Growth chart of William L., age 15 years

If the use of tobacco has an effect upon the ability of an athlete, it is not surprising to know that it interferes with the growth of the body. Indeed, any injurious practice has a more marked effect upon the body during years of growth than in later life. In addition to the effect of the drug itself, there is a loss of appetite which

commonly accompanies the use of tobacco by growing boys.

Perhaps you know a boy whose growth has been affected by the use of tobacco. The growth chart shown here gives a true record of the weight of a fifteen-year-old boy during one winter. You will notice that while he kept up the habit of smoking, he lost weight, and when he gave up the habit, he began to gain. So far as we could learn, there was no change in his habits of living which could account for his loss of weight except smoking.

The amount of money spent for tobacco is more than all the money spent for public schools in the country. Think what it would mean to many boys and girls if this money could be used for purposes of education and health improvement.

Questions to Answer

1. How does a narcotic affect the human body?
2. Tell four ways in which alcohol injures the body.
3. Why is it dangerous to take patent medicines?
4. Why are college athletes forbidden to smoke?
5. Why is tobacco particularly dangerous for a growing boy?
6. What would you rather do with your money than to spend it for tobacco?

XVII

ANIMAL FRIENDS AND ENEMIES

Man has both friends and enemies among the lower animals. If you were to select some of his friends, you would probably name the dog, the horse, and the cow. Among his enemies you might name the wolf and the tiger. Some of the little animals, like the bed-bug, the mosquito, and the louse, are also enemies of man.

Animal relationships.—When we look into this matter further we find that the lower animals, too, have their friends and their enemies. In every case the relationship is chiefly a question of food supply. In fact, for most animals (except those who feed only upon plants) there are: (1) certain kinds of animals upon which they can feed; (2) certain kinds of animals which feed upon them; and (3) certain kinds of animals with which they can coöperate in securing food. This third type of relationship, in which the two kinds of animals can live together to mutual advantage, is less common.

Let us use the hen in illustrating these three relationships. In the first group are the worms and insects, which the hen scratches up for food. In the second group we find the hawk, the fox, and the weasel, which prey upon hens and chickens if they get a chance. We

Ants and plant lice

may place man in the third group of animals so far as the hen is concerned, since the hen supplies man with eggs for food while he protects and feeds the hen.

Another animal which belongs in the *second* group is the *mite,* a small insect which sometimes lives upon the skin and among the feathers of the hen; the mite feeds upon the hen and causes her great discomfort. An animal which lives in or upon another and secures its food from the larger animal is called a *parasite.*

These principles of relationship hold true among the small animals as well as among the larger ones. The ants, for example, feed upon the young of many insects and even attack larger animals in search of food. They have their enemies in the anteater and the birds. Some of them have a very remarkable "friendship" with plant lice, living with them to mutual advantage.

Certain species of ants keep droves of these plant lice in "sheds," as man keeps cows. The plant lice feed upon the sweet juices of roots and stems, and secrete a sweet liquid which the ants use as food. The

ants care for the plant lice somewhat and keep them where there is a good food supply. Such a relationship, which is beneficial to both animals, is called *symbiosis,* or living together.

Every animal, from the lowest to the highest, disregards the welfare of other animals in his quest for food. The wild animals, which would like to feed upon man, cause us little concern. There are, however, several of the small animals, like the mosquito, which feed upon us occasionally. Others, like the louse, become parasites upon the body of man. We save ourselves from these—our little food-seeking enemies—by the cleanliness or sanitation of our houses, our towns, and our cities.

Mosquitoes.—The mosquito gives us a great deal of trouble. There are many species, or kinds, of mosquitoes just as there are many different kinds of beetles or butterflies. The male mosquitoes do not bite, but the females are blood-sucking creatures. They push their hollow, needle-shaped "bills" through the skin, and take their fill of blood. The mosquito bite swells, smarts, and itches.

The bite of most mosquitoes produces no other effects. There are, however, a few species of mosquito whose bite may have more serious results, because they sometimes carry parasitic animals in their bodies which are transferred to man and become parasites in him.

Malaria.—The mosquito which is most dangerous because of the parasite it carries is the Anopheles.

The parasite is a small, one-cell animal which causes malaria. It is so small that it can live and grow in the red blood corpuscles of man, and there it is found in people who have the disease.

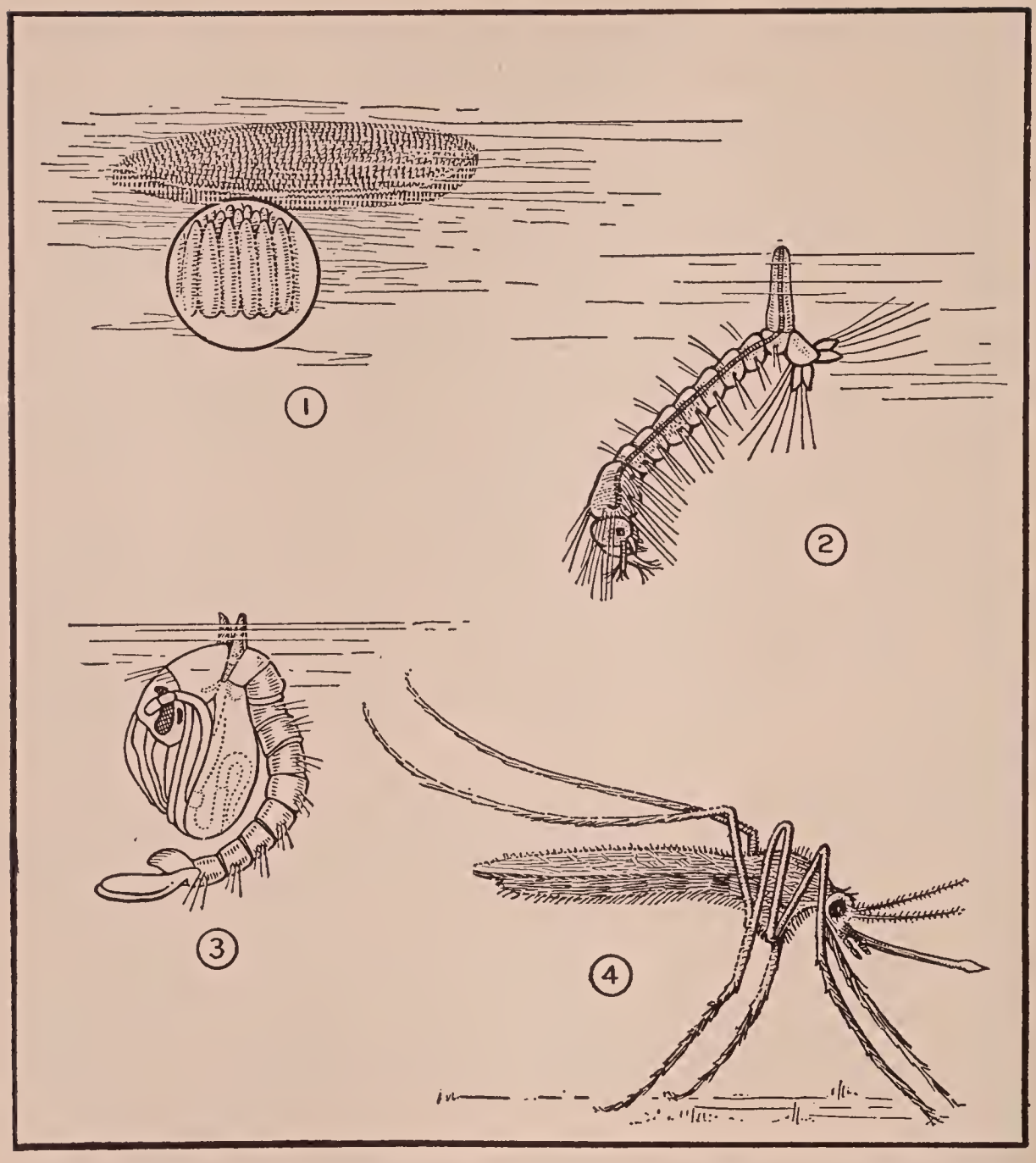
When Mrs. Anopheles Mosquito bites a malaria patient, she draws up some of these parasites with the blood. The parasites live and multiply in the body of the mosquito, find their way to the glands about its mouth, and are introduced into the blood of a well person when the mosquito bites again.

Quinine will kill the malaria parasite in the blood; it is used as a medicine to cure and to prevent the disease. The most effective way to keep malaria away, however, is to keep the place free from the Anopheles mosquito.

Yellow Fever.—Another dangerous species of mosquito is Ædes (formerly called Stegomyia), which carries the parasite of yellow fever. The parasite itself is not known, but we have definite proof that yellow fever is transmitted only by this mosquito. Walter Reed, a young army surgeon, made this life-saving discovery.

There are two other diseases, dengue and filariasis, which are transmitted by other species of mosquitoes.

Mosquito control.—It is to our interest to get rid of all mosquitoes, both those which merely annoy us by biting and those which carry disease. The eggs are laid in water and hatch out into larvæ, or "wigglers," which feed upon tiny plants and particles in the water.



Life history of the mosquito: 1, mosquito eggs floating in water and shown slightly magnified; 2, mosquito larva or wiggler; 3, mosquito pupa or tumbler; 4, full-grown mosquito.

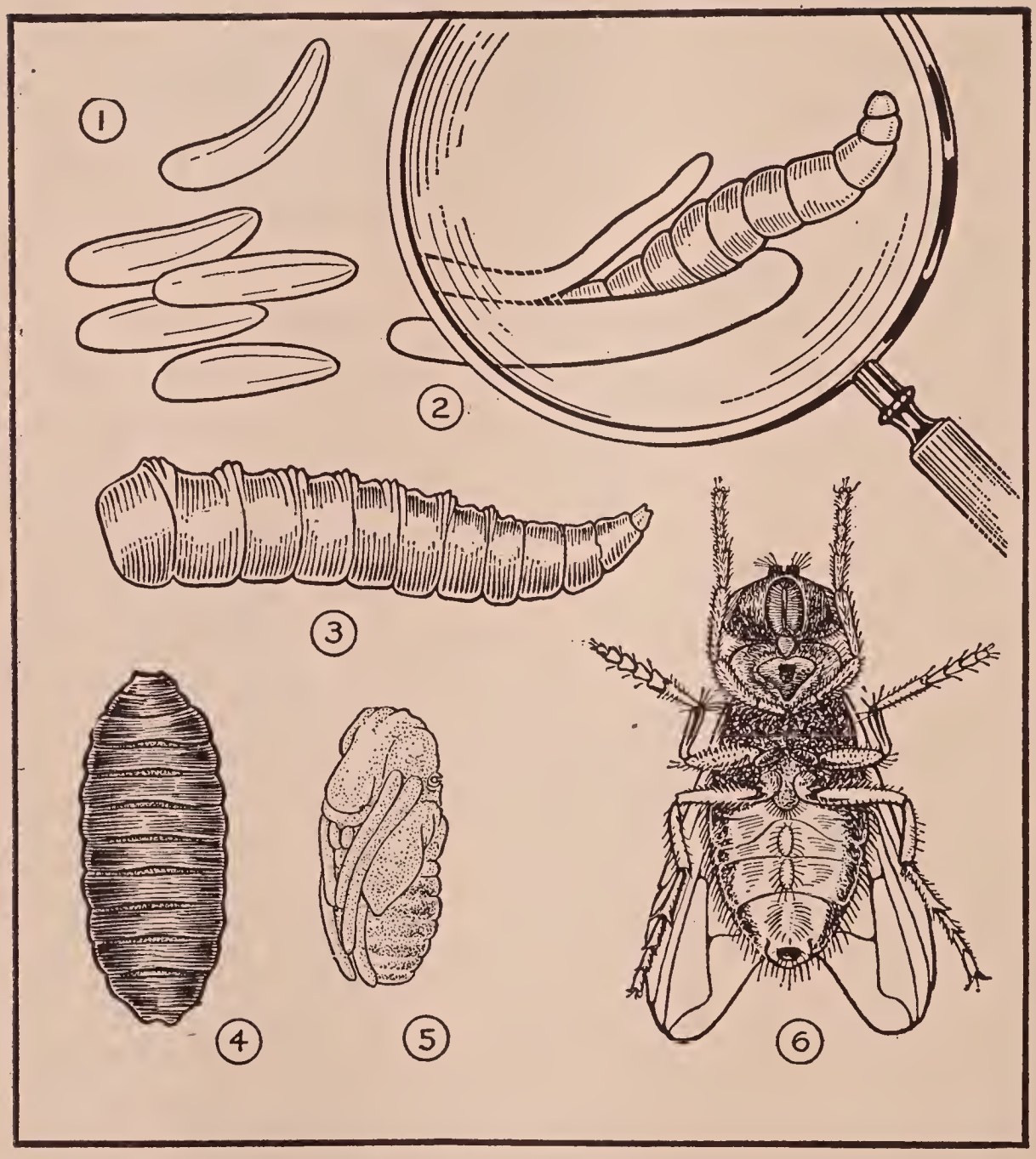
They breathe air by means of a system of tubes running throughout the body, and when they are in need of air, they come up to the top and stick the air tube through the surface of the water.

After a few days the wigglers change into the pupæ, often called "tumblers." The head is very large, and breathing takes place through its two small projections. From this stage the mature insect emerges. The skin of the pupa cracks along the back and the mosquito crawls out, floats for a moment on the old pupa skin, and then flies away.

Stagnant water furnishes breeding places for mosquitoes. This means that rain barrels should be covered, and that pools or cans of standing water should be done away with. Marshes and pools are sometimes drained by the city; if this cannot be done, crude oil is spread over the top of the water. This kills the larvæ and pupæ, because it clogs their air tubes with an injurious substance. Paris green poisons and kills Anopheles larvæ when it is dusted upon the water.

The best illustration of the value of mosquito control is the building of the Panama Canal. Before it was known that mosquitoes carry yellow fever and malaria, an attempt was made to build a canal at Panama; but men could not be kept in good health long enough to do the work. When General Gorgas cleaned up the Canal Zone and got rid of the mosquitoes, these diseases disappeared. The canal was built, and the Canal Zone is now a thoroughly healthful place.

The house fly.—The house fly is another pest. This insect does not bite, but it is likely to bring infection to man. It crawls about over all sorts of filth and then walks over food. The feet and legs of the fly are



Life history of the house fly: 1, eggs of the house fly; 2, larva or maggot hatching from egg; 3, larva; 4, pupa in case; 5, nearly developed pupa; 6, mature house fly as seen when he is walking up the outside of a windowpane.

covered with long hairs which may pick up many bacteria.

The house fly lays its eggs upon animal manure, in garbage, or on some other decaying substance. Within a few hours the eggs hatch into larvæ, which are called *maggots*. The maggots eat almost continuously and grow rapidly. After four days they turn into pupæ. The pupa is a resting stage, during which the animal does not feed, but undergoes a marked change in body structure. At the end of about four days, the fly breaks the shell of the pupa and comes out.

The fly pest can be controlled only by the cleanliness of the home and the community. If proper care is taken to prevent the accumulation of filth in which they can breed, the number of flies will be very small.

Bedbugs.—Another insect pest is the bedbug, which bites man in order to secure food. Its bite is very irritating.

Bedbugs breed in small cracks about the beds or the walls of the room. Once they have established themselves, it is difficult to get rid of them. One way is by fumigating with poisonous gases. Another method is by filling all cracks with gasoline, kerosene, or some other petroleum oil. The use of scalding hot water or soap suds is also effective. The room should be thoroughly cleaned; all cracks and crevices should be closed and covered with a thick coating of paint or varnish.

Lice.—The louse is one of our enemies among the *parasitic* animals. Head lice grow on the scalp, where

they cause irritation and itching as they take their food from the outer part of the skin. The eggs, or nits, are attached to the hair and can be seen readily as tiny white specks.

The lice can be killed by using petroleum or larkspur or certain soaps made for this purpose. The nits are more difficult to get rid of. They must be carefully removed from the hair with the fingers or with a very fine comb; warm vinegar helps to loosen them. Any one *may* become infested with head lice, but no one of clean personal habits will keep them.

Hookworm.—There are some worms which are parasites. One of these is the hookworm.

Hookworm disease is fairly common in the southern part of the United States and in other warm countries. It is caused by a little round worm which gets into the body through the skin of the hands or feet. This parasite finds its way into the blood stream and finally into the intestines, where the worms become mature and lay eggs.

The eggs are discharged with the body wastes. They hatch out into tiny wormlike larvæ, which live for some time in the soil. If they come in contact with the skin, they make their way into the body. Walking barefoot over infected soil, or handling such soil, offers an opportunity of becoming infected with hookworms.

Here again cleanliness is the chief safeguard. If all houses are connected with a sewer or have sanitary privies, there is no chance for the soil to become in-

fected with hookworms, and therefore little chance for the disease to spread.

We have mentioned in this chapter some of the animals which are most important in relation to health. There are a few others which cause occasional trouble; for example, the tapeworm and the porkworm (trichina), which sometimes live in large animals and find their way into man's body through infected meat which is not thoroughly cooked.

Man has no need for anxiety in regard to his animal enemies, because he understands their nature and knows the principles of cleanliness by which they can be avoided.

Questions to Answer

1. What are the three kinds of animal relationships?
2. What is a parasite?
3. How is malaria transmitted?
4. How does one get yellow fever?
5. What is the life history of the mosquito?
6. How do we get rid of mosquitoes?
7. What is the life history of the house fly?
8. How can the fly pest be controlled?
9. How can a room be freed from bedbugs?
10. How can a head infested with lice be made clean?
11. How is the spread of hookworm disease prevented?

XVIII

THE CARE OF FOOD

Just as the farmer learns the science of keeping the weeds out of his gardens, so the modern housewife employs scientific cleanliness in the care of food. She does this for two reasons: (1) to keep the food from spoiling; (2) to protect the health of the family.

It is particularly difficult to protect food from the kinds of bacteria which produce spores. In the formation of spores, the living material, or protoplasm, contracts into a smaller space and forms a thick protecting wall about itself. Spores of bacteria, therefore, are not easily killed by heat or by drying. They can live for a long time even in dry dust. In fact, all dust is likely to contain spores, and when the spores find a place suitable for growth, they turn back into bacteria and multiply rapidly.

There are many ways in which bacteria get into foods —from the air, the dust, and from the hands of people. Flies leave on foods countless bacteria which they have picked up on their feet and legs. They inhabit the most filthy places, and without any washing of feet they crawl about on the baby's milk bottle or on unprotected food. Even with the greatest cleanliness and care in the home, it is difficult to keep food entirely free from bacteria.

General rules for the care of food.—There are certain general rules for the care of food which must be observed by the careful housewife. A few of these rules are listed here.

Avoid careless handling. Certain foods, like fruits and vegetables, can be washed. They may not look dirty, and yet be soiled from handling and from dust. The tops of milk bottles and cream jars should be washed, too, before the cardboard covers are removed. Why would you refuse to exchange food or to eat food picked up from the floor?

Foods which are to be eaten without cooking or washing should be kept covered and protected from dirt in every way. This rule applies to bread, cake, cookies, crackers, candy, pickles, and cooked foods of all kinds. Some of these are kept in the refrigerator, which gives proper protection. Others can be kept in food tins or food jars. The important thing is that they should not be exposed to dust and careless handling. The care of food in the store and restaurant is just as important as its care in the house. Do you ever notice how food is cared for in the stores where you trade?

Foods which spoil quickly should be kept cold. Bacteria increase rapidly in such foods as milk, cream, meat, and fish when they are allowed to stand in warm rooms.

Observe careful habits of cleanliness in the preparation of food. Have your hands clean when you start. If you have to use a handkerchief, pick up something

from the floor, or come in contact with anything which will soil your hands, you should wash them again. Careless habits, such as licking the fingers or dipping the tasting spoon back into food, have no place in the modern kitchen.

People who prepare food should be free from contagious diseases. Cooks, kitchen maids, and restaurant workers are dangerous to the health of others if they carry such diseases as tuberculosis, typhoid fever, or diphtheria. Even in a case of common cold, a person should stop cooking for other members of the family, or should take every possible precaution to see that the cold does not spread to others through the food. How can this be done?

Food should be protected from flies, water bugs, ants, and mice. Most housewives do this in two ways: (1) by keeping the house rid of vermin; (2) by caring for food in such a way that an occasional "visitor" cannot reach it. Discuss in class methods of keeping the household rid of pests. Why are they dangerous to health?

The care of milk.—Certain foods spoil quickly unless they receive special care. It is hard to keep milk from spoiling because bacteria grow in it so readily. You remember that the conditions favorable for the growth of bacteria are food, moisture, partial or complete darkness, and proper temperature. All of these conditions may be found in milk.

Milk is a watery fluid which contains sugar, protein,

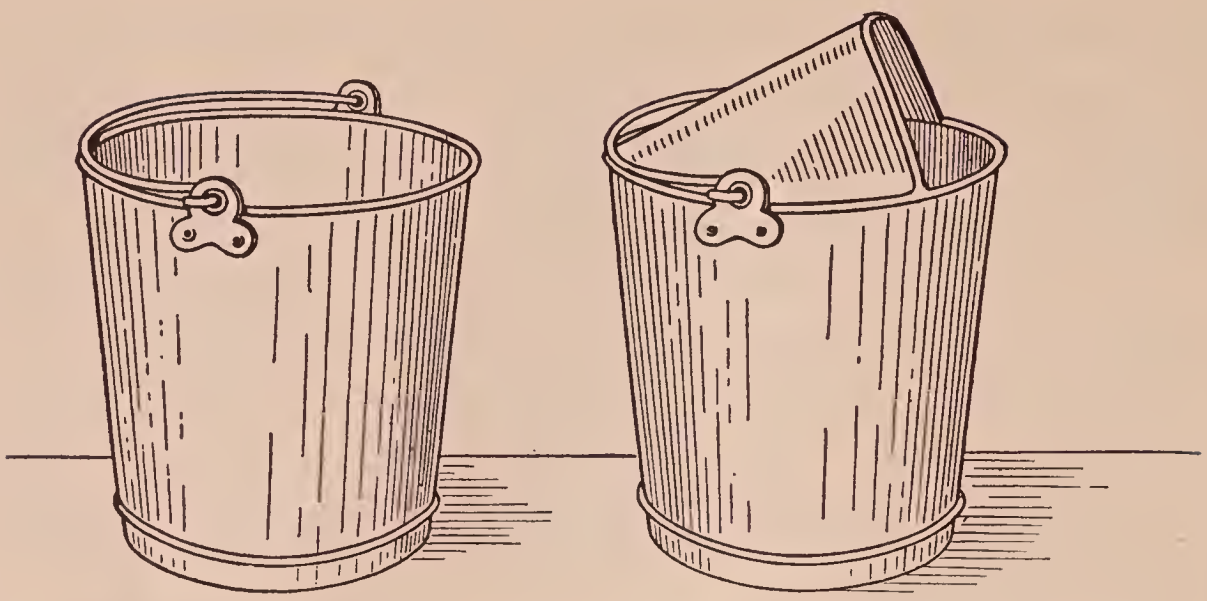
fat, minerals, and vitamins. Bacteria do not attack fats, but there are several kinds which feed upon milk sugar and sour the milk. There are other varieties which live upon milk protein and putrefy the milk.

As milk comes from the body of the cow it is warm. Moreover, it is an opaque fluid; that is, the sun does not shine through it as it does through water. You cannot look through it. So even if the milk were set in the sunlight, the bacteria would still be protected from the rays of the sun.

Usually there is excellent opportunity for bacteria to settle into milk at the time of milking unless particular care is taken. These bacteria may have come from the dust of the air, from dirt on the cow's body, or from the milker's hands and clothing. Clean milk comes from clean, healthy cows. Clean barns, clean milkers, clean people to handle the milk, clean utensils, prompt cooling of the milk, and early delivery are all important.

You have very little direct control over the milk before it reaches you, but you can help to give it the proper care in your home. If bottles are left daily by the milkman, they should be left in a place where cats and dogs cannot lick the tops or push out the stoppers. Do not allow the milk to get warm by standing in the sun.

If you live where you take your own can or bottle to get milk, be sure that it is kept perfectly clean, and that the milk is covered while you are bringing it home. All utensils used for milk need to be thoroughly washed



Which is the more sanitary type of milk pail? Why?

in hot, soapy water and then scalded. Bottles are better than cans. Do you know why?

Milk should be kept cold at all times; it should not be left standing about in a warm kitchen or dining room. The refrigerator is the best place to keep milk cold, of course. A fairly good way of keeping it cold when you are camping or when you get out of ice is to wrap a wet cloth about the bottle and place it in a pan of water so that the cloth is constantly wet. The evaporation of water from the cloth keeps the milk cold.

Sometimes people turn fresh milk into a pitcher which already contains some left-over milk. Milk keeps longer if it is not mixed in this way. You can see for yourself the reason why. The "old" milk contains more bacteria than the fresh milk, and the presence of these bacteria in the mixed milk will hasten the spoiling process.

The spoiling of milk.—The usual way in which milk spoils is by souring. This is caused by the lactic acid bacteria feeding upon the milk sugar, turning it into lactic acid. Sour milk is perfectly wholesome, and may be used in cooking. Indeed, milk soured in special ways is regarded by many as particularly wholesome.

Another spoiling process sometimes takes place. This is called putrefaction. It is caused by a change in the proteins of the milk, due to the feeding of certain bacteria. In this state, the milk becomes slightly yellow and appears spongy or stringy. It tastes bitter, and is not fit for use.

Milk is such an important food that extreme care should be taken to have it produced under clean conditions and protected in every way. Nothing takes the place of milk for growing children. It contains the best proteins for growth; it has fat and sugar in forms most easily used by the body; and it is rich in minerals and vitamins. For babies, it is nature's perfect food. For older children and adults, it forms a most valuable part of the diet.

Milk as a food for infants.—Nature planned mother's milk for very small babies, and there are many reasons why it is better for them than cow's milk. In the first place, the composition of mother's milk is different. It contains more sugar than cow's milk, only about one-third as much protein, and one-third as much mineral substance. The baby can digest mother's milk much

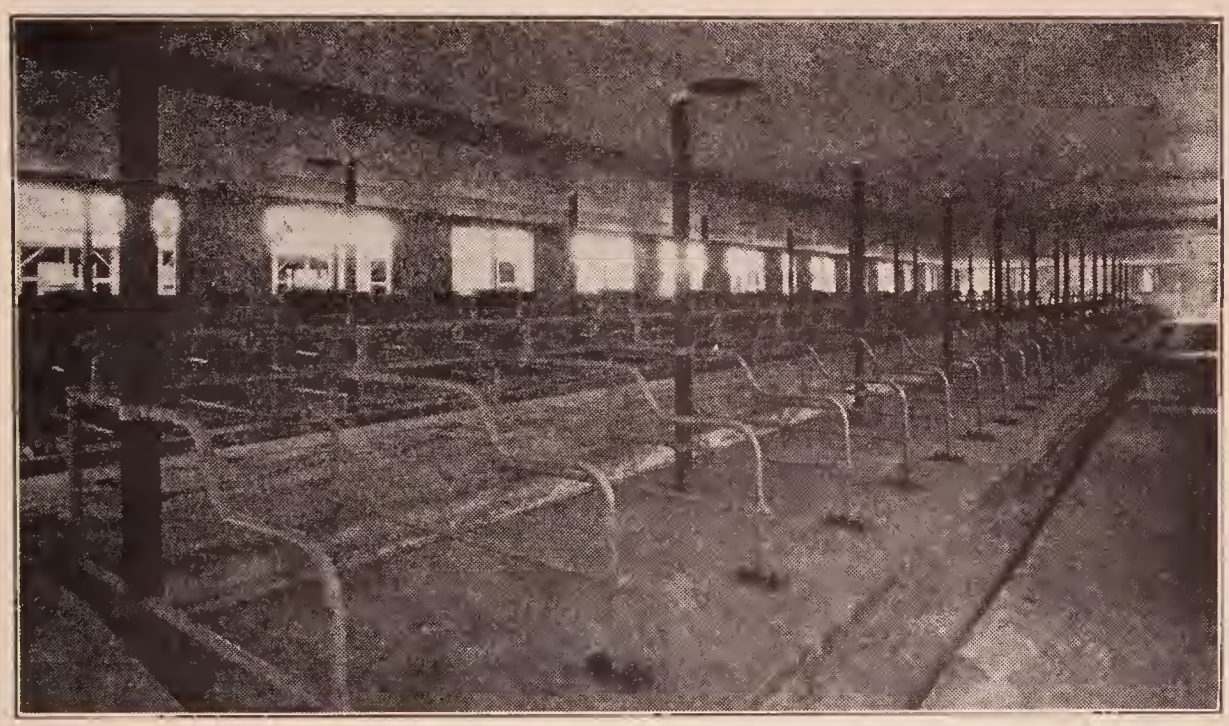
more easily and use its various substances for growth more readily. In fact, cow's milk cannot be modified to *exactly* take the place of mother's milk, although of course it has to be used for children whose mothers cannot nurse them.

Another advantage of mother's milk is that it is taken directly by the baby with no chance for the entrance of harmful bacteria. Sometimes disease-producing bacteria get into milk; so you can see that a baby brought up on mother's milk has a better chance of keeping well than a baby fed with cow's milk.

Safe milk.—There are several harmful bacteria which may get into milk. If the cow is sick with tuberculosis, the tubercle bacillus may be present. If people who handle milk have the germs of typhoid fever, diphtheria, or certain other diseases about their bodies, these bacteria may get into the milk. If milk is to be safe, it must come from healthy cows and be handled only by clean and healthy people.

In a large city it is not always possible to know the conditions under which milk was produced. In order to make the milk supply safe, therefore, a process is carried out which kills all the dangerous bacteria and most of those which sour the milk. This process is called *pasteurization*.

Pasteurization involves the heating of the milk to a temperature high enough to kill bacteria, but not high enough to change its taste noticeably. The name "pasteurization" is used because it is practically the same



The model dairy barn is clean, light, and airy.

process as that originated by Louis Pasteur to kill the bacteria which caused the spoiling of wines and beer.

In pasteurizing milk on a large scale, it is heated in tanks or in bottles. It is kept either at a temperature of 140° to 145° Fahrenheit for thirty minutes or at a temperature of not less than 160° Fahrenheit for at least twenty seconds. When milk is pasteurized in the bottles, it is ready for shipment after it is thoroughly chilled. You can see at once that this is the best way of pasteurizing milk, because there is no opportunity for bacteria to enter it after pasteurization is completed. When milk is pasteurized in bulk, however, it is usually bottled at once, and if the methods are clean, the process may be quite satisfactory. In the city, pasteurization of milk is usually *required*.

The use of refrigeration in the care of food.—The most important means of preserving food at present is by coldness, or refrigeration. Before the use of ice became common, women used cold cellars, deep wells, or spring houses as places for storing food. Now nearly every home and every modern market or store has its ice-box or electric refrigerator. Refrigerators which operate automatically, using electricity or gas, have an advantage over the ice-box in keeping a lower and more even temperature.

Refrigeration is carried on to an even greater extent in the cold storage plant of the present day.

There is some prejudice against cold storage goods; but, as a matter of fact, foods may remain in storage for a very long time without spoiling in the least, provided they are fresh and in good condition when put in, and provided they are not taken out until they are about to be used. Once foods are taken from the cold storage plant, they are likely to spoil very quickly. The reason for this is that moisture collects on the cold surface of the food and mixes with the natural juices, thus making a condition very favorable to the rapid growth of bacteria.

Canning.—Canning is another method of preserving food. The process is essentially the same whether it is done in cans at the factory or in glass jars at home. Discuss in class the various methods of canning. Why must food be boiled for a certain length of time to prevent its spoiling? Why is it best to boil it in the jar? Why is the cleanliness of the jar important?

Molds, as well as bacteria, are killed in the canning process. If canned goods spoil, it is either because the process of sterilization was imperfect, or because the jar was not tightly sealed, thereby letting in bacteria or spores of mold.

Drying.—One of the oldest known ways of preserving food is by drying. Bacteria must have moisture in order to grow. When a food substance is thoroughly dried, therefore, conditions are no longer favorable for them. Fruits, vegetables, meat, fish, eggs, and even milk are preserved by drying. What is done with dried foods before they are ready to be eaten? What dried foods does your mother use, and how does she prepare them?

Smoking.—Some foods are preserved by a process of smoking. In the smoke there is a substance called creosote which kills bacteria. What foods are smoked? How is smoking done?

Pickling and salting.—Pickling and salting are methods of preserving which have long been used in the home and in commerce. What foods are preserved in this way?

You may have noticed that cucumbers shrink and become wrinkled when they are made into salt pickles. This is because the salt has such a strong attraction for water that the water in the vegetable is actually drawn out. For a similar reason, bacteria cannot live in salt solutions; they cannot hold the water necessary for life against the attraction of the salt. Strong vinegar will also preserve foods.

Pickling and salting are less desirable ways of preserving because the taste of the food is changed and the nutritive value greatly reduced. Pickled or salted foods are hard to digest, because the salt or acid which has penetrated through the food hinders the work of the digestive juices. Some foods, such as cucumbers and green tomatoes, are unripe when they are pickled, and therefore are doubly hard to digest.

Sugar preserves.—Sugar is often used in preserving fruits. Like salt, it has a strong attraction for water. It draws water from the fruit and from the bacteria, making it impossible for the latter to hold water enough for growth. Jams and sweet preserves keep indefinitely, even if they are not air-tight and even though mold may grow on top.

A small amount of sugar does not preserve food, but rather increases its tendency to spoil. Bacteria flourish on sugar when it is not present in such quantities as to deprive them of the moisture necessary for life inside the cell.

THINGS YOU MAY LIKE TO DO

1. Keep part of a bottle of milk at school for a week or so, watching the changes which take place in it: (1) the sour taste; (2) the separation of the clabber from the whey products of the milk; (3) the final stages of spoiling marked by the spongy appearance of the clabber, and the dried, moldy appearance on top. The milk should not be tasted in this final stage; it is bitter and unwholesome.
2. Use a class questionnaire to find out the following things in regard to the use of milk:

(*a*) What is the average amount of milk used in your family every day?

(*b*) How much milk do you drink every day?

(*c*) Where does your milk come from: a milkman, a store, a near-by farm, your own cows?

(*d*) Is it pasteurized or raw?

(*e*) In what ways do you protect milk from spoiling after it comes into your home?

3. Collect an exhibit of foods, showing as many ways as possible in which foods are "preserved" to keep them from spoiling.
4. Make a list of general rules for the care of food in the home.

XIX

CLEANLINESS IN THE HOME

The word "home" probably brings a distinct image before you. In your mind you see the rooms of the house where you live. Whether it be a country house or a city apartment, it has a certain attractiveness in your eyes. That attraction is not merely because of the physical comfort you find there, but because of the family ties which bind together the people who make up a home. This is the "spirit" of home which poets write about, which artists try to portray in painting, and which musicians tell about in song. Those of us who know happy homes do not need to learn from poet, artist, or musician. The joy of home is written in our hearts.

Because home is so closely a part of life itself, it is vastly important that the home be wisely managed. Because habits in the home are so closely related to the health of the family, the regulation of the home in matters of cleanliness is equally important. "Keeping house" loses some of its drudgery when one remembers how the health and happiness of the family depend upon the well-kept home. Even the much-despised task of "doing dishes" takes on a new interest when one understands how clean dishes protect the health of

those who use them. Preparing a meal becomes a scientific adventure in serving foods which are clean, nutritious, and attractive. Who could wish to miss a share in the happy responsibility of running a home!

Indeed, no one *should* miss a share. A mother, a father, or a housekeeper alone cannot keep a house clean and wholesome. Nothing short of the coöperation of every one living in the home can do that. What use is it for father to have the house well screened if *you* leave the screen doors open? What good does it do for mother to have the bathroom fixtures scrubbed if *you* are careless? What use is there for absolute cleanliness in the kitchen if *you* handle food with dirty hands or cough and sneeze upon it? No matter, then, whether you are in charge of the home or not, you have a very definite responsibility toward its cleanliness, from the standpoint both of your personal habits and of your share in its work.

From the standpoint of health, the home must observe three general principles in order to be successful. First, it must possess a spirit of harmony which makes for cheerfulness and happiness in the family. Second, it must provide the daily comforts and necessities of life. Third, it must be cared for with proper cleanliness to protect the family from disease. This chapter deals only with the third principle—the requirements for a clean home.

Keeping dishes clean.—You already know that the care of food is one of the most important considera-

tions in a clean home. The cleanliness of dishes is equally important. Indeed, it is impossible to serve a family with food which is clean and safe unless the dishes are properly cared for. It is easy to understand that bacteria or other microörganisms can live on dishes which are merely rinsed off in lukewarm, greasy dishwater and wiped on soiled towels. Colds, or even more serious kinds of illness, are undoubtedly spread in a family by means of poorly washed dishes and table silver.

Clean dishes are more attractive, too. A meal served with shining dishes and polished silverware is much more appetizing than one served with greasy dishes and blackened or tarnished silver.

The only way to have clean dishes is to wash them thoroughly. Scrape them first, or rinse them under the faucet, so as to avoid dirt and grease in the dishpan. Use hot, soapy dishwater so that your washing process will remove all bits of greasy food and all deposits from the mouth which stick to the silverware, cups, and glasses.

You need to be especially careful in washing the articles which come directly in contact with the mouth. Glasses should never be *merely rinsed* because they *look* clean. The rim of the glass should be *washed thoroughly*. Wash your teacups and silver, too, with greatest care. Scald the dishes with hot water if you can. This makes them cleaner, helps you to dry them more easily, and gives them a better polish. If you

have many dishes to wash, change your dishwater before it becomes greasy and dirty.

Here is the usual order of washing dishes: (1) glasses; (2) silver; (3) cups and saucers; (4) other table dishes; (5) cooking dishes. Keep your pots and pans as clean as your dishes. They need hot, soapy water for washing and clear, hot water for rinsing. Even if the bottom of a kettle is black from kerosene or wood smoke, the inside should be perfectly clean.

When there is illness from contagious disease, try to keep the patient's dishes separate. They can be placed on a tray used only for the patient, and washed

by themselves, instead of with the other dishes. A separate dishcloth and towel should be kept for washing and drying them.

Clean dishcloths and towels add greatly to the fun of "doing dishes." They add greatly to the cleanliness of the dishes, too. Wash your dishtowels frequently and dry them outdoors. If your towels are well cared for, they will look clean and smell sweet with the freshness of outdoor air and sunshine. Towels should be washed after each meal, if possible, but washing once a day may be quite satisfactory, if several towels are used and dried thoroughly. Why would you be unwilling to dry dishes with towels which are washed only occasionally and dried imperfectly?

Probably you have found from experience that dishcloths and dishmops become grimy very quickly unless they are washed well every time they are used. Where do you hang them to dry? What do you think of keeping dishmops in a closet under the sink? What sort of care do you give to the dishpan?

Dishes may be dried without towels by the method of rinsing and draining. This is not only a very *clean* way of drying dishes; it is a *time-saving* device, too. The dishes are set up in a rack so that they can be thoroughly rinsed with scalding water. Then they are allowed to remain in the rack until dry. Glasses usually cannot be dried in this way, because they will look streaked. Silver also must be wiped. Other dishes need to be very well rinsed so that all traces of soap are removed.

The care of the refrigerator.—What an attractive place the refrigerator seems when you go to it on a warm summer day in search of a cool drink or a bit of refreshing food! It is certainly pleasant to have the refrigerator kept fresh and neat.

Indeed, a refrigerator cannot do its work well unless it is kept very cold and clean. The dark, moist interior of a warm ice-box will favor the growth of molds and bacteria rather than discourage it. If you want to have your ice-box really cold, you must see that it is shut up tightly and supplied with a good-sized piece of ice.

Ice which is wrapped in cloth or newspaper will not chill the box to a desired temperature. No doubt you have found that it is poor economy to let the ice supply get too low, because more ice is used to reduce the temperature again, and in the meantime your food may spoil. A good automatic refrigerator will maintain a low temperature.

You need to consider the question of odors in the refrigerator because it is shut up so tightly that strong odors like those of cheese and fish may be absorbed by foods like milk, cream, and butter. Avoid keeping "strong" foods in the refrigerator if possible. Protect your milk and butter from taking undesirable odors by keeping these foods covered.

Cleanliness in the kitchen.—The scientific housekeeper prides herself that her kitchen is the cleanest room in the house. It is flooded with sunlight, the friend of health and cleanliness. Its windows and doors are well screened in summer so that the kitchen may be airy and cool without the entrance of flies. It is kept as free from dust as possible. The floor is mopped or washed rather than swept. Indeed, it is an attractive room, well suited in every way to the needs of its mistress.

A kitchen which is pleasing in other ways may be spoiled by a dirty sink. The sink must be kept free from water-bugs, or cockroaches, which breed in dark, damp, dirty places, and bring on their bodies whatever kinds of bacteria they chance to pick up. You can

fight these pests by three methods: (1) use a good roach powder; (2) get rid of the damp, dirty places in which they may breed; (3) keep all food (including crumbs and garbage) out of their reach.

Sometimes there is trouble with odor from the sink drain, even when the sink itself is kept very clean. This odor is not dangerous, as people sometimes think, but it is undesirable, of course, and indicates an unclean condition somewhere in the drain pipe. In any type of sink drain there is a "trap" which holds a small amount of water to prevent the sewer gas from coming up into the room. If dirty, greasy water is allowed to remain in the trap constantly, you are likely to get odor from it. You can avoid such a condition by flushing the pipe with hot, soapy water every day so that you clean the trap thoroughly and leave it filled with clean water instead of dirty water.

The care of garbage is another important problem in kitchen work. Make a practice of removing the waste food from the kitchen after each meal. A dish of waste in the sink is unsightly; it attracts flies and water-bugs, and in warm weather it may give off disagreeable odors. Keep your container for garbage outdoors if you can. In winter it may seem necessary to keep it in a back room or shed. In any case, it should be kept covered and emptied often.

Do you wash out your garbage container after the garbage is emptied? You ought to clean it thoroughly because the waste which accumulates on the sides of the

can will develop a sour smell, which is disagreeable and which attracts flies. Flies will breed in garbage if they have a chance. Be sure that your containers are tightly covered.

If you live in the city, your garbage is collected at regular intervals; but if you live in the country, you have to dispose of your own kitchen waste. Parts of garbage may be fed to hens or pigs. Other satisfactory ways of disposal are by burning or burying. The important thing is to get rid of the waste without breeding flies or attracting rats and mice.

Care of the bathroom.—The average person is very critical of the bathroom in another person's house. Look carefully at your own bathroom, "making believe" that it belongs to some one else. Does its cleanliness please you?

Each member of the family should have his own towels, washcloths, and soap, and a place for keeping them. Since you understand how easily bacteria can be carried about, you can see why people, even within the same family, should be fastidious in regard to using personal belongings. You have a right to resent the use of your towel or bathbrush by another person. You also have the obligation to treat the other person's belongings with the same sort of respect which you ask for your own.

Many people use paper towels; they are cheap, clean, and very convenient. Paper towels are good in the kitchen, too.

The washbowl should be kept clean. Brush your teeth over a bowl which is not used for washing purposes if you can conveniently do so. If you have to use the washbowl, be careful to rinse it thoroughly afterward with hot water.

Washing and ironing.—What a pleasure it is to have clean clothes! Clothing which is washed well and dried outdoors is indeed "really clean."

The clothes are scrubbed in hot, soapy water either by a mechanical "washer" or by hand. They may also be boiled over the fire, although this is not absolutely necessary. They are well rinsed once or twice in plenty of clean water. Then they are hung on the line where Mother Nature lavishes upon them the purifying touch of her servants, the air and the sun.

If you iron clothes, you add still another step to the disinfecting process. Ironing is usually done for the sake of appearance, however, rather than for the sake of cleanliness.

Clothes "half washed" in lukewarm water, carelessly rinsed in only a small amount of water, and dried in a dingy back room will not look clean or smell clean. Indeed, they are not clean, for although certain spots of dirt may be removed, the most dangerous part of the dirt may still remain. You can judge that colds and other kinds of illness may often spread through the family when washing is done in such a careless fashion.

Care of bedrooms.—Think what a large part of your life is spent in bed! Surely it is important that

beds and bedrooms should receive proper care every day.

One of the chief requirements for a bedroom is fresh air. Some people keep their bedroom windows open all the time, day and night. You may not like to do that in cold weather, and it is not really necessary that you should. You should make a practice, however, of having the windows open for a part of every day so as to air the bedding thoroughly, and of course you want them open at night. When the weather is so stormy or cold that you cannot have windows wide open while you sleep, you can have them partly open at top and bottom so as to give a good circulation of air. The cool, moving air with its slight variations in temperature and moisture acts like a tonic on the skin and brings refreshing sleep.

The bedding should be pulled back and aired every day in your room, and occasionally put outdoors for a thorough airing in the sun. Mattresses and pillows need to be protected from direct contact with the body because they cannot be cleaned so easily as the rest of the bedding. Blankets, quilts, and puffs should be protected, too, by sheets and spreads. Which do you think better for general use—blankets or quilts?

The care of the cellar.—A cellar which is damp, dark, and unventilated offers a first-class place for the breeding of molds and bacteria. If the wall or floor is broken, there is a chance for drainage from the soil to leak in, or even opportunity for rats and mice to enter the house.

Often the cellar is used as a storage place for food or household goods. A good cellar is light, reasonably dry, well ventilated, and tight in construction. Keep it clean, and paint or whitewash the walls occasionally.

Cleaning and dusting.—Every girl knows how much a room is improved by cleaning and dusting. Most of you know, too, that there are many different ways of doing this work, and that some methods "raise the dust" more than others. What are the best ways

of cleaning rugs and carpets? What cleaning methods do you prefer for waxed or polished floors? How would you care for floors in the pantry and kitchen? If you sweep, how can you prevent the scattering of dust from the floor? What kinds of dusters are best? What kinds of dusters should never be used?

What a big and important job it is—keeping a home! Those of us who spend most of the day in school, at the office, or in the factory must not forget that the one who keeps the home is doing a work equally important, and in most cases equally difficult. Let us appreciate her task. Let us coöperate with her to maintain a home which shall be a center of health and happiness for the family.

THINGS YOU MAY LIKE TO DO

1. Make a set of brief rules for each of the following:
   (a) Washing dishes.
   (b) Caring for the refrigerator.
   (c) Keeping the kitchen clean.
   (d) Taking care of the bathroom.
   (e) Washing and ironing.
   (f) Caring for bedrooms.
   (g) Keeping the cellar clean.
   (h) Cleaning and dusting.
2. By posters or scrapbook work illustrate as many rules as you can for the care of the home.
3. If you have responsibilities for certain parts of the housework at home, check yourself to see if you are doing the best you can. Watch yourself in at least one particular and see if you can improve until the better practice becomes a habit.

4. Make up a questionnaire in class which will include questions related to your coöperation in the home. Answer the questions honestly, and see how many points you can score. Check over the questionnaires from the class and see what practices are most poorly followed. Here are a few questions which might be asked:
   (a) When you help to "do the dishes," do you wash your hands first?
   (b) Is your part of dishwashing done according to the rules of cleanliness you have learned in your health class?
   (c) Are you careful never to use dish towels for anything except dishes?
   (d) Do you make a practice of always closing the door of the refrigerator?
   (e) Are you careful never to spill things in the refrigerator?
   (f) If you help to care for the garbage, do you follow the rules which have been made in class?
5. Discuss the use of individual drinking cups at home and in public places.
6. Have a committee from the class investigate the condition of washrooms and toilets in the school. Remember your own responsibility in helping to keep these places clean.

APPENDIX

This appendix suggests some class procedures which have been found useful in school health work.

Weighing and Measuring

All weighing and measuring should be done carefully and accurately. Weighing should be done once a month, if possible, always at about the same time of day. Height should be taken two or three times during the year: at the beginning, in January or February, and again in June. It is desirable to weigh and measure without shoes. All extra clothing, such as sweaters and coats, should be removed.

Weighing. Before weighing, the scales should be tested for balance by pushing the balance weights back to zero. When the scales are found to vary somewhat from an accurate balance, they should be adjusted by the Sealer of Weights and Measures or by the teacher. If the scales are moved from one room to another, care should be taken to keep the platform relatively horizontal, so that the adjustment of the mechanism under the platform is not disturbed. The child being weighed should stand quietly in the middle of the platform with hands at the sides.

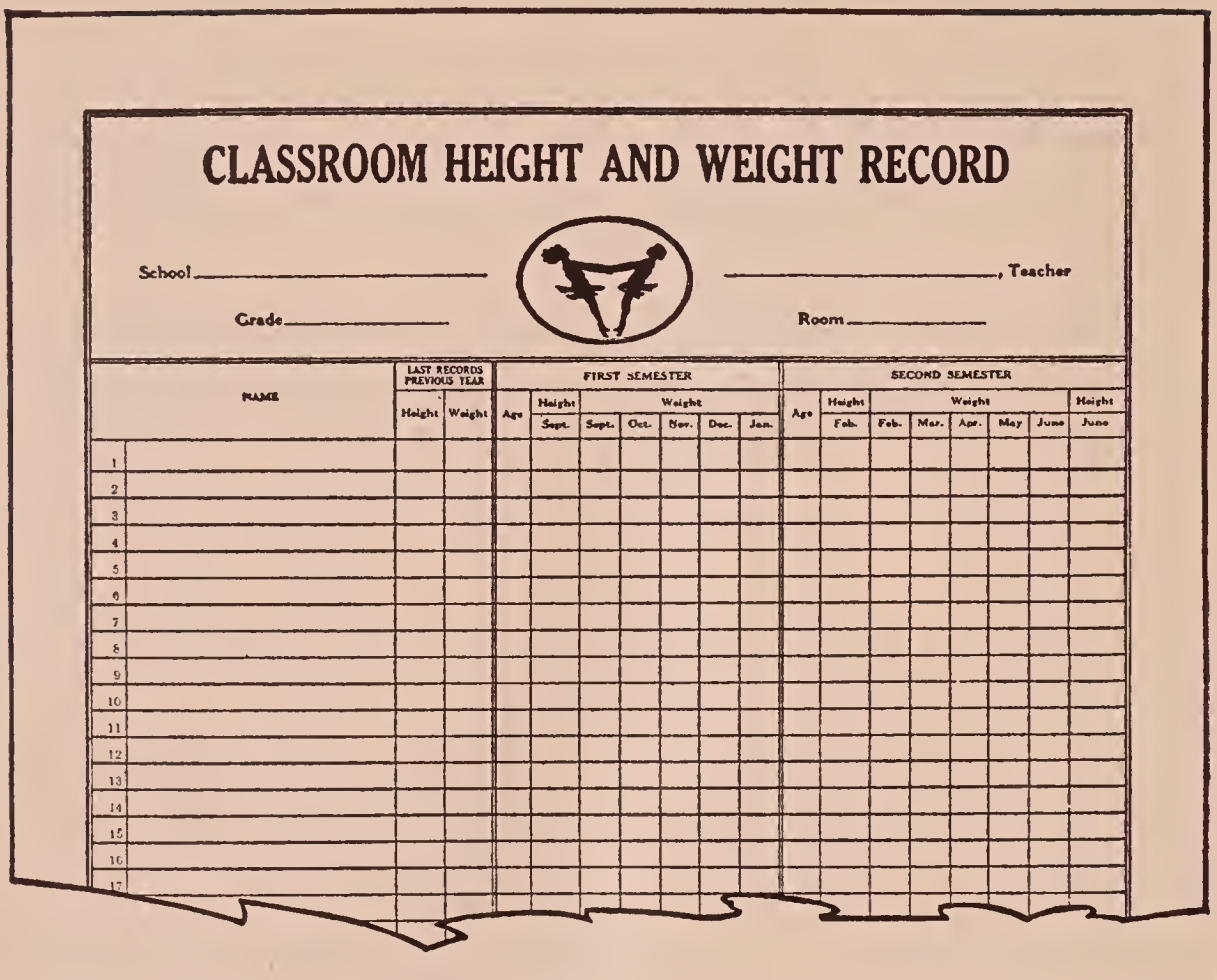
MEASURING. Two instruments are necessary for measuring—an accurate scale against which the child will stand to be measured, and a leveling device which can be placed on the child's head to secure a right angle measurement against the scale.

One of the best measuring scales is made of inextensible and unshrinkable paper, which may be tacked or pasted to a wall or specially prepared board. You may use yardsticks fastened one above another on a smooth wall, or a tape measure tacked to the wall. Be careful to have them accurately placed. Such a scale should be checked by a standard steel tape.

The leveling device may be made of two pieces of seasoned walnut board about seven by five inches. On the inside of the median line is a narrow strip with an opening which serves as a handle. If such a measuring device cannot be secured conveniently, a box with a square edge may be used. (A chalk box serves the purpose very well.) The flat surface of a book or board cannot be used accurately, because one cannot be sure that it will always make a right angle with the scale on the wall.

The child being measured should stand as tall as possible with heels together and with his back and head against the wall where the scale is placed. The arms are at the side, and the eyes are straight ahead.

RECORDS. It is well to keep two sets of records—one on a Classroom Weight Record sheet, and another on individual weight cards. A regular form of "Class-



CLASSROOM HEIGHT AND WEIGHT RECORD

School _____ , Teacher _____

Grade _____ Room _____

	NAME	LAST RECORDS PREVIOUS YEAR		FIRST SEMESTER							SECOND SEMESTER							
		Height	Weight	Age	Height	Weight					Age	Height	Weight					Height
					Sept.	Sept.	Oct.	Nov.	Dec.	Jan.		Feb.	Feb.	Mar.	Apr.	May	June	June
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		

room Weight Record" can be secured from the Bureau of Education, Department of the Interior, Washington, D. C. The classroom record should be kept hanging in the classroom where children can refer to it at any time. Individual cards, or tags, can be carried home each month to be signed by the parent. The record should give height, weight, and monthly gains.

It is desirable that the pupils in the class should have as large a share as possible in the weighing and measuring activities. Certain ones can learn to do the weighing, others to do the measuring. Each child may have a part in keeping his records; he can record the figures on his own card or on the Classroom Weight Record at the time he is weighed.

MALDEN PUBLIC SCHOOLS

Name **School**

Date of Birth **Grade**

19.....		Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	
Age												
Height												
Weight												
Month's Gain												

Directions for Making a Weight Graph

Use paper which is already "squared" for graphs, or rule a sheet of drawing paper for the purpose. The horizontal lines will represent "pounds of weight." The vertical lines will represent the "months" or the times at which the weighings are made.

Each horizontal line should be marked with a figure to show the number of pounds, but the numbers will be different for each of you because your weights are different. The vertical lines should be marked with the names of the months, and *on these lines* dots are placed to indicate weight at weighing periods. The solid black line drawn between these dots makes a weight line, which falls when you are losing weight and rises when you are gaining weight.

You can draw a light pencil line to represent your "expected" gain if you wish. Find out the average monthly gain for a child of your age, and draw from the first dot, which represents your actual weight, a line which will show the amount of "expected" gain per month.

You will understand that the table shows the average gain for a group of boys or girls. It does not mean that every boy and girl should gain the stated amount each month. Some will gain more, and some will gain less. Children differ in size, and it is not expected that every one will grow at the same rate. You may not gain every single month, but you will usually make some gain. You will be more likely to gain if your health habits are good than if they are poor. If a child does not gain in weight for three months or more, it is well to try to find out the reason for it.

Tables Showing Average Monthly Gains *

I. *About what a GIRL should gain*

Age	Gain
From 5 yr. to 8 yr.	6 oz.
8 yr. to 11 yr.	8 oz.
11 yr. to 14 yr.	12 oz.
14 yr. to 16 yr.	8 oz.
16 yr. to 18 yr.	4 oz.

II. *About what a BOY should gain*

Age	Gain
From 5 yr. to 8 yr.	6 oz.
8 yr. to 12 yr.	8 oz.
12 yr. to 16 yr.	16 oz.
16 yr. to 18 yr.	8 oz.

* From tables prepared by Bird T. Baldwin, Ph.D., and Thomas D. Wood, M.D. Reproduced by permission of the American Child Health Association.

Questionnaires

A very good way for a class to find out how much they are "investing" in health habits is for them to check themselves up by means of a questionnaire. The following questions suggest some that may be included:

1. What time did you go to bed last night?
2. What time did you get up this morning?
3. How many hours of sleep did you have?
4. What did you eat for breakfast this morning?
5. What vegetables did you eat yesterday?
6. What fruit, either raw or cooked, did you eat yesterday?
7. What cereal did you eat yesterday?
8. How many glasses of milk did you drink yesterday?
9. How much water did you drink yesterday?
10. How many cups of tea did you drink yesterday?
11. Did you eat candy between meals yesterday?
12. How long did you play outdoors yesterday?
13. How many times did you brush your teeth yesterday?
14. Have you had a full, warm bath during the last week?
15. Did you have a bowel movement yesterday?
16. What health habits have you improved the past year?

Boys and girls may prefer to make a questionnaire of their own. They may change some of these questions or add others to the list. Each pupil should answer the questionnaire frankly, telling exactly what he *did,* not what he knows he should have done; and then the answers should be scored. It is not necessary that each one should write out the questions on paper. They can be written on the blackboard, arranged in order with each question numbered. Then the answers may be numbered in the same way on paper.

The answers to the questionnaire should relate to what each child did yesterday and this morning; they should not be made on the basis of what a child *usually* does. The real purpose of the questionnaire is to determine the health habits of the class on one particular day.

After each pupil has checked his own answers, score each question for the class as a whole. What habits are most carefully practiced? What habits most need improvement? What can be done about it?

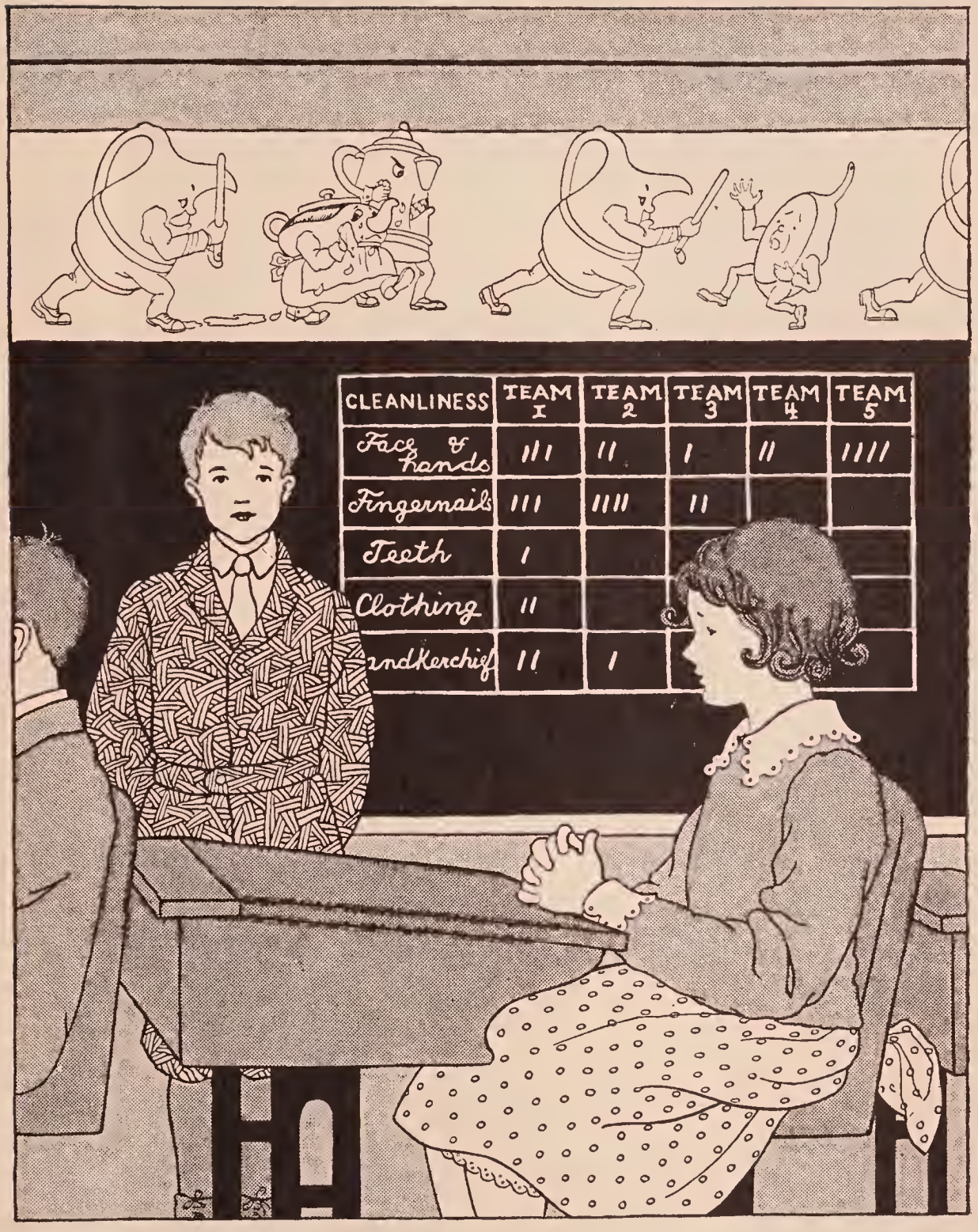
Inspections

(The method here described is one carried on by health club organizations. The same sort of inspection can be used, however, even if the class does not choose to have a regular health club.)

In making daily inspections, certain inspection questions should be decided upon either by the class as a whole or by an elected committee. The following are examples of questions used:

1. How many have clean faces, clean necks, and clean ears?
2. How many have clean hands and finger nails?
3 How many have finger nails not bitten?
4. How many have clean teeth?
5. How many are wearing neither coats, sweaters, nor rubbers, and have neat clothing?
6. How many are carrying clean handkerchiefs?

The procedure of inspection may be somewhat as follows: The secretary, with the teacher's help, has ruled



off a place at the board where scores for each team (each row) may be recorded. At the time of inspection the secretary will take his place at the board to make the records. When the president asks the first inspection

question, each captain goes to his assigned row and makes inspection. He then offers himself to the president for personal inspection and tells the captain who is inspecting his own team whether he passed.

After that he returns to the back of his assigned row to give his report. As the president calls for the reports by rows, the captain calls the number of the team and gives score of *one* if each pupil in the row has passed; if some one failed to pass, he reports *zero*. (For example, he may say, "Team 2, score 1.")

Other records may be kept from time to time in a way similar to the inspection records. These may be made of questions to be answered by each child "upon his honor." Such questions as these might be used:

1. How many cleaned their teeth before going to bed last night and before coming to school this morning?
2. How many drank at least two glasses of milk yesterday?
3. How many ate some vegetable besides potato yesterday?
4. How many ate some fruit yesterday?
5. How many slept ten hours or more last night with open windows?

Recording Health Habits

Each habit record should be kept for at least a two-week period. This sort of record-keeping gives a chance for the class discussion of particular habits, and it serves as a campaign in favor of one habit after another to fix each one more firmly.

It is possible to secure a little health-habit booklet

I played out of doors to-day

	1st Week	*2d Week*
Sun.		
Mon.		
Tues.		
Wed.		
Thurs.		
Fri.		
Sat.		

in which such records may be kept. ("Health Habit Record," D. C. Heath and Company.) A page from such a record book is printed on page 227. It is not necessary to have a special record book like this, however. Children can prepare their own record sheets by ruling up paper in a similar way.

The advantage of keeping records does not lie in having a perfect record, of course. It is merely a way of reminding one's self to keep the habits until they are firmly established. The test of health habits comes on weighing day. They show in health improvement.

Health Clubs

The Health Club offers one way of organizing a class for health improvement. It should include every one in the class; and it should be conducted in accordance with Parliamentary Law.

At the first meeting, the teacher may act as temporary chairman. She calls the meeting to order. Under her leadership, the club elects a president, vice-president, and secretary. Most health clubs do not have a treasurer, but if your club should wish to assess dues or raise money for any purpose, it will be necessary to have one. The officers should be changed from time to time.

It is usually convenient to divide the class into small groups, or teams, for working at inspections and health records. The classroom has the natural division of

rows, and each row may well constitute a team. Each team should select a captain.

The duties of officers are as follows:

The *president* shall call all meetings to order and take charge of them. He shall ask the secretary for minutes of the previous meeting and for announcements or reports. He shall ask the club for business, and shall regulate the discussion. He shall conduct all

activities of the club, such as inspections and the use of health-habit questionnaires.

The *vice-president* shall have charge of meetings at such times as the president is not able to do so.

The *secretary* shall keep and read the minutes of club meetings. He shall be responsible for all records of team work or other activities of the club. He shall make all announcements and reports.

The *treasurer* shall have charge of all funds of the club and render account.

The *captains* shall act as leaders of their own teams, encouraging them to do their best, and setting them a good example at all times. In campaigns upon particular habits the captains will take all records for their teams and report them to the secretary. In making inspections the captain will not inspect his own team usually. He will be assigned by the president to inspect some other team.

It is desirable that a health club should hold a meeting once a week. The method of procedure may be somewhat as follows: The president calls the meeting to order. He asks the secretary to read the minutes of the last meeting, and gives opportunity for any one to make corrections or additions before declaring them approved. He may ask the secretary for additional reports or announcements.

If inspections for that day are included in your club program, instead of at the opening of school, he may then ask for inspection, which will be made according to some standards decided upon by the club. After in-

spection, the president may call for a discussion of business. This may include appointment of committees for special work, reports of special committees, and suggestions for new work. This preliminary part of the meeting, conducted in a brisk, businesslike manner, should use only ten or fifteen minutes, except when some unusually important business is brought up for discussion. The club may use some of the health or hygiene periods for its meetings.

The *rest of the club period* may then be used for some work in regard to *health habits*. Material for this work is given in Chapter III of the text. Once a month, at least, the health club time should be used for discussing the results of weighing.

The teams may serve as committees, with the captains acting as chairmen. For example, the teams may take turns in preparing programs; these may deal with some particular health habit, a survey of the class or school, a consideration of the results of weighing and measuring, or any other appropriate topic.

There are many other things which a health club can do to good advantage, such as making posters or scrapbooks, keeping weight graphs, planning exhibits, developing plays, keeping honor rolls for teeth.

The test of the health club is its influence upon the members of the class in producing better health habits and improved health. The interesting devices used in your club work count as nothing unless the boys and girls show in their appearance and growth records the results of healthful living.

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